A Dissertation on

"A PROSPECTIVE, RANDOMIZED COMPARATIVE STUDY ON EFFECT OF PRESERATIVE FREE KETAMINE WITH LEVOBUPIVACAINE VS LEVOBUPIVACAINE FOR CAUDAL BLOCK IN LOWER ABDOMINAL SURGERIES IN CHILDREN''

Submitted to the

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In partial fulfilment of the requirements

For the award of degree of

M.D. (Branch-X)

ANAESTHESIOLOGY

INSTITUTE OF ANAESTHESIOLOGY & CRITICAL CARE

MADRAS MEDICAL COLLEGE

CHENNAI- 600 003.

APRIL 2013

CERTIFICATE

This is to certify that the dissertation entitled, "**A PROSPECTIVE, RANDOMIZED COMPARATIVE STUDY ON EFFECT OF PRESERATIVE FREE KETAMINE WITH LEVOBUPIVACAINE VS LEVOBUPIVACAINE FOR CAUDAL BLOCK IN LOWER ABDOMINAL SURGERIES IN CHILDREN**" submitted by Dr. **SARAVANAN.S** in partial fulfilment for the award of the degree of Doctor of Medicine in Anaesthesiology by the Tamilnadu Dr. M.G.R. Medical University, Chennai is bonafide record of the work done by him in the INSTITUTE OF ANAESTHESIOLOGY & CRITICAL CARE, Madras Medical College, during the academic year 2010-2013.

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DECLARATION

I hereby declare that the dissertation entitled "**A PROSPECTIVE, RANDOMIZED COMPARATIVE STUDY ON EFFECT OF PRESERATIVE FREE KETAMINE WITH LEVOBUPIVACAINE VS LEVOBUPIVACAINE FOR CAUDAL BLOCK IN LOWER ABDOMINAL SURGERIES IN CHILDREN**" has been prepared by me under the guidance of **PROF. Dr.V. PANKAJAVALLI . MD DA,** Professor , Institute of child health and Research centre , Madras Medical College , Chennai in partial fulfillment of the regulation for the award of the degree of M.D [Anaesthesiology] , examination to be held in April 2013.

This study was conducted at Institute of child health and research centre, Madras medical college, Chennai.

I have not submitted this dissertation previously to any university for the award of any degree or diploma .

Date :

Place : Chennai **Dr. S .SARAVANAN**

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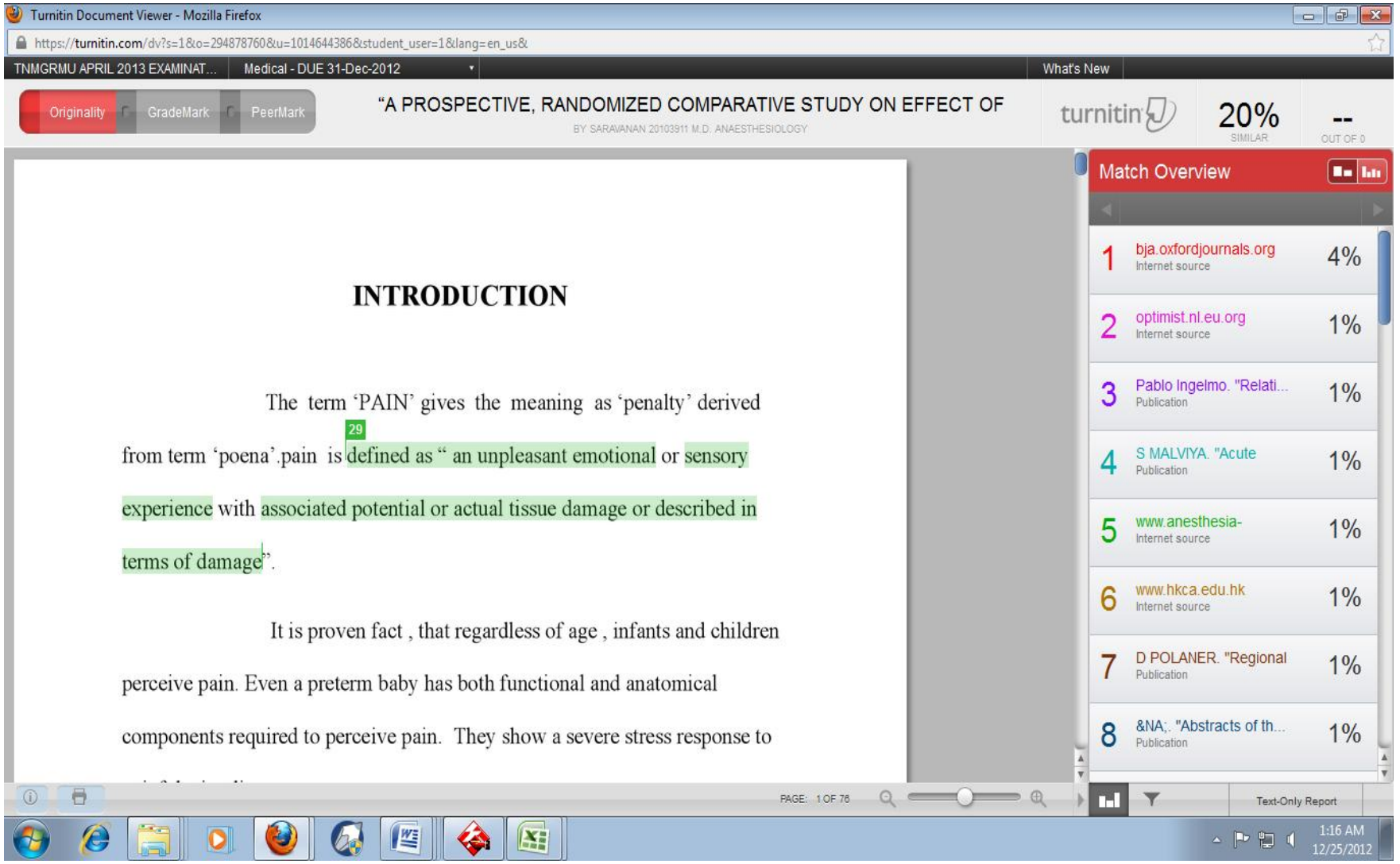
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INTRODUCTION
The term 'PAIN' gives the meaning as 'penalty' derived from term 'poena'.pain is defined as " an unpleasant emotional or sensory experience with associated potential or actual tissue damage or described in terms of damage".
It is proven fact , that regardless of age , infants and children perceive pain. Even a preterm baby has both functional and anatomical components required to perceive pain. They show a severe stress response to
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INTRODUCTION

The term ‘PAIN’ gives the meaning as ‘penalty’ derived from term ‘poena’. Pain is defined as “ an unpleasant emotional or sensory experience with associated potential or actual tissue damage or described in terms of damage”.

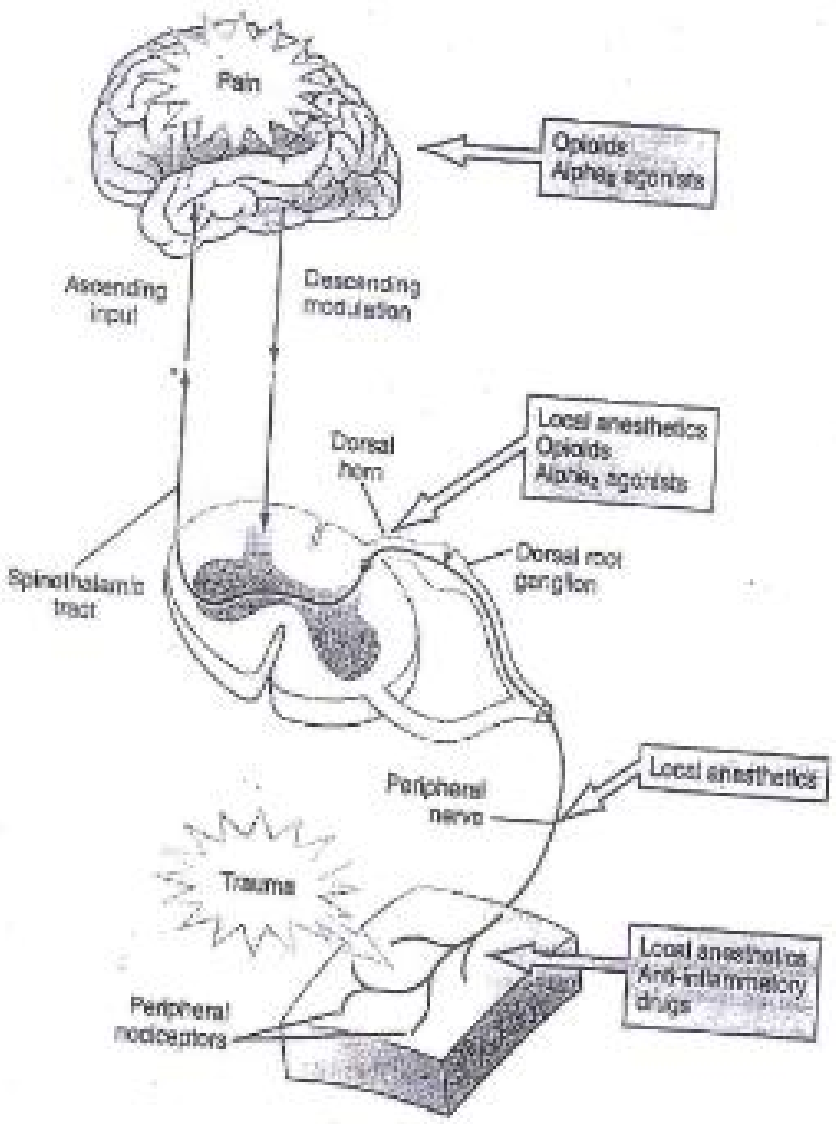
It is proven fact , that regardless of age , infants and children perceive pain. Even a preterm baby has both functional and anatomical components required to perceive pain. They show a severe stress response to painful stimuli.

Whenever there is a noxious stimuli at the time of injury , it induces a local inflammatory response in the periphery, i.e there is sensitization of nociceptors and primary hyperalgesia.

The noxious input is conducted to CNS by A delta and C fibers. It initiates a sequence of events i.e reflex withdrawal from stimulus, aversive behaviour and pain perception.

The sustained noxious input from C fiber produces central sensitization, which in turn alters sensory processing in spinal cord finally leading to allodynia and hyperalgesia at the site of injury.

Pathway of pain is illustrated in the figure. There are several sites in the pain pathway that can be targeted for the effective treatment of pain .



At the peripheral level , local anaesthetics , peripheral nerve blockade , NSAIDS , opiods can be used to treat pain .

At the level of spinal cord opiods , alpha -2 agonists and local anaesthetics can be used .

At the cortical level , opiods can be used. Mostly combined mode of therapies are used to treat pain effectively.

Certain differences in the mechanism of pain response have been observed in early life as follows :

1. In case of neonate , threshold for pain sensation is lower than that of adults and they have exaggerated reflex responses.

2. There is less co-ordination in the motor component of withdrawal reflex. There is involvement of whole body movements during withdrawal response.

3. The receptive fields of sensory neurons are comparatively larger and there is greater overlapping, which in turn influences sensory localization and discrimination.

4. In case of adults, input from sustained C fiber causes CNS stimulation in response to noxious stimuli. Functioning of A delta and C fiber begins to matures after birth and C fiber activity

attains maturity much later. In early life , it is the A delta fiber which involves in central sensitization rather than C fiber.

5. There is no complete maturity in peripheral inflammatory response at birth.

ASSESSMENT OF PAIN :

1. Self report measures : eg. VAS , Faces , Manchester pain scales.

2. Observational behavioural measures : eg. CHEOPS, FLACC, Comfort scale

“ FLACC Behavioral pain scale: Total Score 0 – 10

Categories	0	1	2
Face	No expression or smile	Occasional grimace, withdrawn, disinterested	Frequent to constant frown, clenched jaw,
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry, awake or asleep	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to distractible	Difficult to control of comfort ”

AIM OF THE STUDY

This study compares the efficacy of producing postoperative pain relief and safety of using caudal epidural administration of 1ml/kg of 0.25% levobupivacaine with 0.5mg/kg preservative free ketamine vs levobupivacaine alone in 60 children between ages 6months to 8 years who underwent lower abdominal surgery.

ANATOMY OF CAUDAL EPIDURAL SPACE

Armitage in 1879 performed the first caudal epidural block. It is performed via the sacral hiatus to reach the caudal epidural space.

This caudal epidural space is clinically significant because the caudal epidural blockade is the most commonly performed technique in the paediatric age group for surgeries involving the perineum , lower limb and lower abdominal regions .

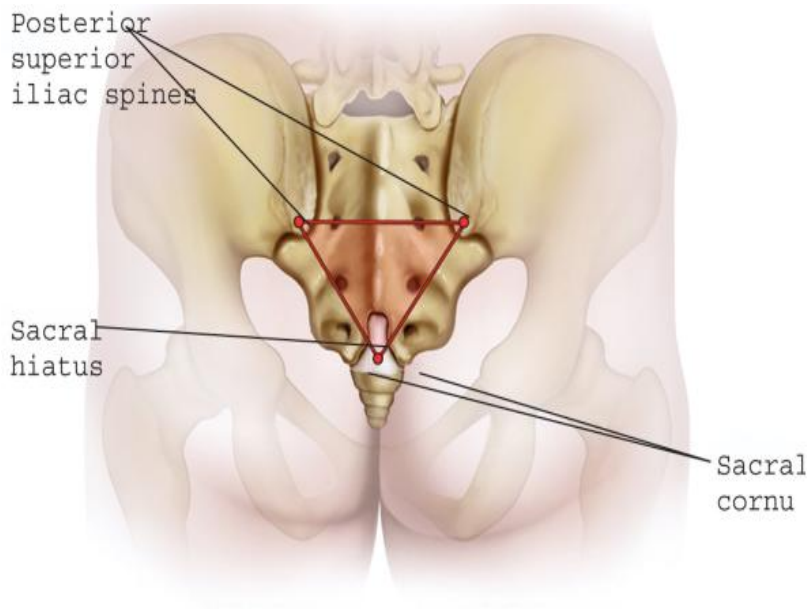
The epidural space can be easily reached via the sacral hiatus because level of termination of duramater of the spinal cord is at the level of second sacral segment .

Beyond the level of second sacral vertebra , epidural space continues . The sacral nerve roots and lower lumbar nerve roots are found emerging at this level .

Infiltration of the Local anaesthetic at this level provides analgesia and anaesthesia of perineum . When the volume of local anaesthetic is increased further it may involve the lower lumbar roots as well . Large volume of the drugs will extend the effect to the lower lumbar roots.

ANATOMY OF SACRAL HIATUS

The sacral hiatus is a gap in the lower dorsal aspect of the sacrum which is usually triangular in shape . In normal adult , the fifth and fourth sacral vertebral arches fail to fuse dorsally leading to a ‘ v ’ shaped opening known as sacral hiatus.



BOUNDARIES OF SACRAL HIATUS :

Its lateral margin is formed by the sacral cornua, which is a palpable bony margin of unfused lamina of 5^{th} sacral segment. The fused lamina of 4 th sacral segment forms the superior boundary,

while posterior surface of the body of 5th sacral segmen forms the inferior boundary.

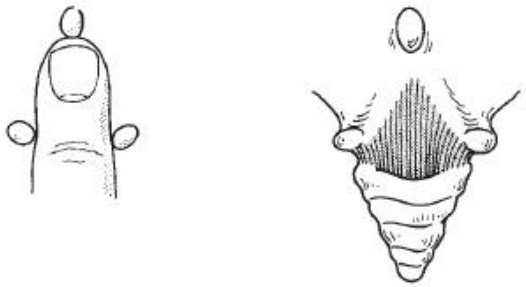
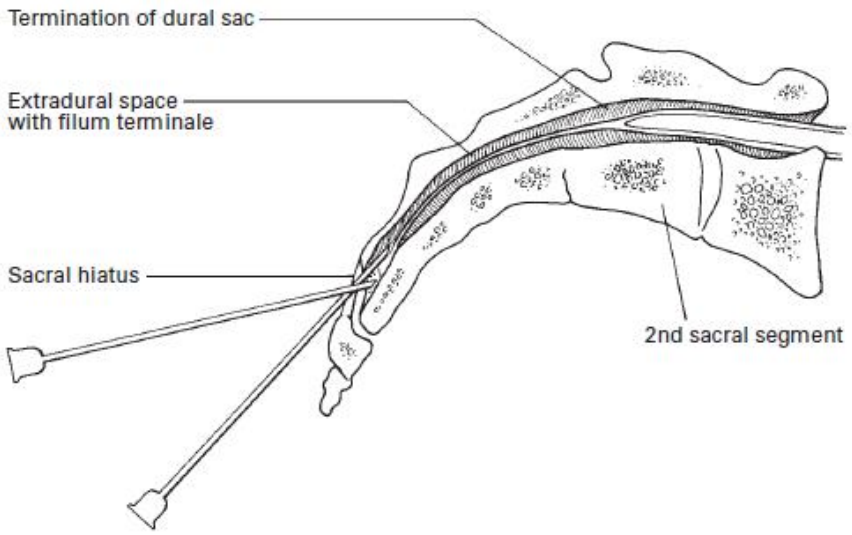


Fig. 88 The sacral cornua delimit the sacral hiatus.



The sacral hiatus is covered dorsally by the continuation of ligamentum flava known as the sacrococcygeal membrane , which lies beneath the skin and subcutaneous fat.

Clinically, it can be located palpating the depression in between the sacral cornua. Certain factors like age and weight of the patient influence the distance to reach the epidural space from the skin.

The apt size of needle is 25 mm long needle. It is adequate to reach the sacral epidural space and can prevent inadvertent dural puncture.

It is difficult to perform caudal epidural anaesthesia in paediatric age group in more than 6 -7 years. This is because as the age advances , there is change in the axis of the sacrum and sacral hiatus may close.

INDICATIONS AND CONTRAINDICATIONS

INDICATIONS :

Caudal epidural anaesthesia is indicated for surgeries below the diaphragm especially in sacral , lower lumbar areas and lower limbs for example lower abdominal surgical procedures , including inguinal hernia repair , urinary and lower digestive tract surgery and orthopedic procedure on the pelvic girdle and lower extremities.

CONTRA INDICATIONS :

- Bleeding diathesis
- Sacral malformations
- Raised intra cranial pressure
- Meningitis

TECHNIQUE OF CAUDAL EPIDURAL ANAESTHESIA :

The patient is placed in the lateral position with thighs flexed at right angles to the hip.

The sacral hiatus is identified and a 22 gauge short bevelled needle is inserted at an angle of 60 degrees with its apex until a distinct pop is felt.

At this point the sacro coccygeal membrane is best felt by the needle and is the deepest part of the sacral canal so that the entire bevel of the needle is within the canal.

A longer bevel may be partly outside the canal or may traumatise a vessel or periosteum as it is advanced .

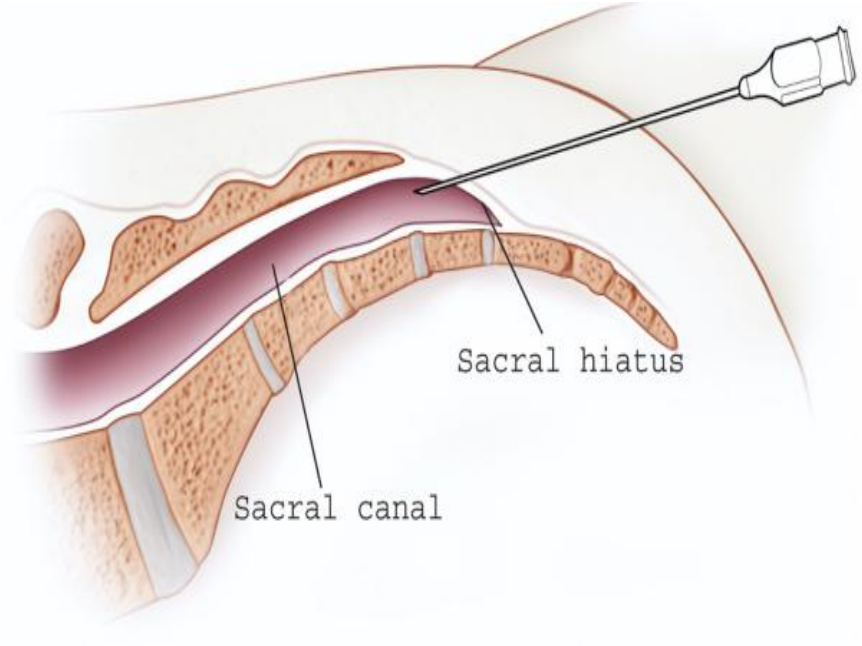
The needle is stabilised , careful aspiration for blood and CSF is performed and the drug administerd in small aliquots with repeated aspiration.

Careful observation of ECG [looking for doubling in size of the T wave or tachycardia as a sign of intravascular injection] is needed at the time of drug administration.

Some authors suggest decrease in angle of entry to 30 to 45 degrees and advancing a few mm. This may be necessary in the smaller infants who have a shallower canal or when using a longer bevel needle , to ensure that the whole bevel is inside the canal [beware of dural puncture with the longer bevel and this technique].

It is easier to do the block with saline filled 2ml syringe with a small air bubble entrapped in it attached to the needle. This is easier to hold like a pen and the position may be tested straight away. Free flow of saline without the change in the shape of the air bubble confirms the correct placement.

Alternatively a 22 gauge iv cannula may be used . After Puncture of sacrococcygeal membrane , cannula should easily slide off the needle into the epidural space.



CONTINUOUS CAUDAL EPIDURAL BLOCK :

Indications are similar to the single shot , but this block is used when the patient will benefit from prolonged analgesia . The procedure is the same as described above but the needle used is larger.

It should be either a Crawford needle or large iv cannula [a 21 gauge epidural catheter will usually pass through a 18 gauge iv cannula] for the caudal approach ; a paediatric tuohy needle may

misdirect a caudal catheter since the tip directs the epidural catheter laterally.

In all cases , check that the catheter will pass through the needle and check the length of the needle with reference to the catheter. Once the needle is in place , the catheter is advanced 2 to 3 cms or more, depending on the level of block required.

The catheter tip is placed at or near the midpoint of the dermatomes involved in the surgical incisions.

Bosenberg et al have threaded catheters up from caudal to the thoracic level in children less than 6 years of age in order to provide continuous thoracic epidural analgesia.

It is possible however for such catheters to become lodged in a dural sleeve or to become kinked. A post operative x ray may help to confirm correct placement.

A double occlusive dressing should be applied to reduce of faecal contamination of puncture site.

SELECTION OF DRUG

Calculation of dose of local anaesthetic is based on two formulae namely Modified Armitage formula and Takasaki's formula

Two factors influence the drug dosage to be administered for caudal epidural blockade .They are the volume of local anaesthetic [not concentration], and epidural space volume. The volume of epidural space is not a constant one. It varies with age. Among the two formulae , Takasaki's formula gives best approximated dose with comparatively better clinical results.

'' TAKASAKI'S FORMULA :

Volume (ml) = 0.05ml /kg/dermatome to be blocked "

Caudal epidural anaesthesia is basically a single shot technique. The dosage of Armitage reminds the most dependable .

"ARMITAGE'S FORMULA :

With 0.05 ml/kg all sacral dermatomes are blocked, 1ml/kg sacral and lumbar dermatomes are blocked, 1.25ml/kg blocks lower thoracic dermatomes." However when, 1.5ml/kg is injected there is a danger of excessive rostral spread (above T4).

The level of block depends on volume of drug infiltrated influences or in other words determines the block level . The density of block depends upon the concentration of the local anaesthetic, where dense blockade is necessary for intraoperative anaesthesia and the blockade can be less dense for postoperative analgesia,.

COMPLICATION

Accidental intravascular or intraosseous injection

Vascular Injury leading to hematoma

Neural injury

Infection - It is of grave concern especially when it occurs in either the subarachoid or the epidural space.

Meningitis and epidural abscess are the most potential serious complication. The signs and symptoms are the same for epidural abscess and hematoma except fever, raised ESR and leukocyte count which is associated with previous one. Whenever a child develops pyrexia of unknown origin with an indwelling caudal / epidural catheter , it is mandatory to remove the catheter immediately.

Epidural hematoma is a very rare complication. Rapid diagnosis , immediate intervention and decompression of the hematoma gives better outcomes.

Patients with clinically significant bleeding diathesis , thrompocytopenia are especially at a very high risk of developing epidural haematoma .These conditions are definitely a contraindication to central neuroaxial blockade.

Another rare complication associated with epidural blockade is Urinary retention. with use of opioids.

Block failure rate is 3 to 5% and failure rate increases especially in children older than 7years of age.

PHARMACOLOGY OF LEVOBUPIVACAINE

It belongs to the amino amide group of local anaesthetics. S-enantiomer of Bupivacaine is known as levobupivacaine.

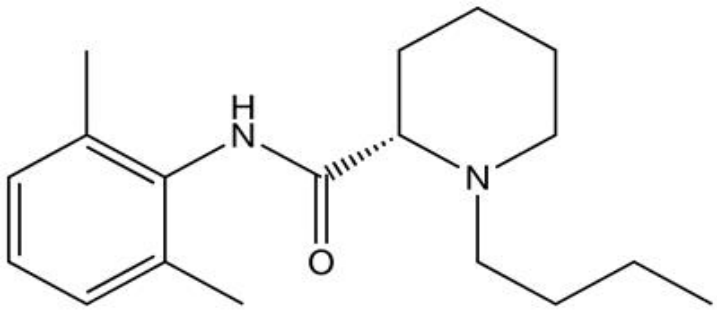
It is commercially used in the form of water soluble hydrochloride salt solution.

Levobupivacaine is associated with relatively longer duration of action and vasodilation is less when compared with Bupivacaine. Its potency is 13% less than that of Bupivacaine.

CHEMICAL STRUCTURE :

It has a hydrophilic and lipophilic portion separated by a interconnecting hydrocarbon chain.

The hydrophilic portion is a tertiary amine usually and the lipophilic portion has an unsaturated aromatic ring.



Bupivacaine is available as racemic mixture of levo and dextro enantiomer. Levobupivacaine is the levo enantiomer which produces less neuro toxicity and cardio toxicity than dextro enantiomer and racemic mixture.

PHARMACOLOGICAL PROFILE OF LEVO BUPIVACAINE:

Onset - slow

Duration after infiltration - 240 - 480 mins

Maximum single dose for infiltration - 175 mg

Toxic plasma concentration - >3 micro gram / ml

Pka - 8.1

Protein binding - >97%

Volume of distribution - 55 litres

Elimination half life - 156 mins

MECHANISM OF ACTION :

It acts by blocking the sodium channels which are ion selective and inhibits the passage of sodium ions through them thereby preventing the transmission of nerve impulses.

The threshold potential or resting membrane potential is not altered . It binds to alpha – subunit of sodium channel whereas beta subunit modulate the binding of local anaesthetic to alpha subunit.

It also blocks the voltage dependent potassium ion channels but with a lower affinity.This explains the broadening of action potential.

PHARMACO KINETICS :

The rate of tissue distribution and rate of clearance of the drug influences its plasma concentration.

Also, the tissue blood flow, lipid solubility, patient related factors like age, hepatic function,cardiovascular status influence absorption and plasma concentration.

It is more widely distributed in tissues than the ester group. Protein binding influences distribution and excretion of drug. Protein binding parallels lipid solubility,both are inversely related to plasma concentration of drug.

It is extracted by lung after instillation, limiting the concentration reaching the cerebral and coronary circulation. This pulmonary extraction is dose dependent.

METABOLISM :

It is metabolised mainly in the liver by microsomal enzymes. Levobupivacaine undergoes slowest metabolism among amide group, leading to sustained increase of plasma concentration.

It is metabolised by aromatic hydroxylation . N – dealkylation, amide hydrolysis and conjugation.

After regional anaesthesia, N- dealkylated metabolite N-desbutyl bupivacaine can be measured in urine or blood.

The important plasma protein binding site of levobupivacaine is alpha-1 acid glycoprotein.

ADVERSE EFFECTS :

ALLERGIC REACTIONS :

It is usually due to usage of methylparaben or similar substances in preservatives used in commercial preparations, which are structurally similar to para amino benzoic acid.

It is due to prior stimulation of antibody production by preservatives. Cross sensitivity can occur between local anaesthetics

belonging to same group because of common metabolite para amino benzoic acid.

SYSTEMIC TOXICITY :

It is due to excess plasma concentration of Levobupivacaine. It depends on the rate of drug introduced, redistribution and clearance of the drug. Accidental direct intravascular injection produces excess plasma concentration.

When the plasma concentration is more than 2 – 2.5 microgm / ml, CNS toxicity occurs. Cardiac and CNS toxicity occur simultaneously in paediatric age group because plasma protein binding is lower. It crosses blood brain barrier and CNS function is altered.

As the plasma concentration increases, sequence of symptoms manifest usually. But in case of paediatric age group,it is not as obviously seen as in adults.

The threshold for cardiac toxicity is lower for levobupivacaine in case of paediatric age group. Therefore both CNS and cardiac toxicity occur concurrently in infants and children. Sometimes CNS toxicity is preceeded by Cardiac toxicity.

When volatile anaesthetics are used concomitantly, the risk of cardiac toxicity is increased. Moreover general anaesthetic effects over CNS will obscure signs of CNS toxicity.

In case of adults, first and foremost symptom is circumoral paresthesia due to high tissue concentration. It is followed by dizziness, light headedness, visual and auditory disturbances.

Shivering , muscle twitching, and slurred speech are the signs of CNS toxicity. When the plasma concentration increases further,it results in generalized seizures due to CNS excitation.

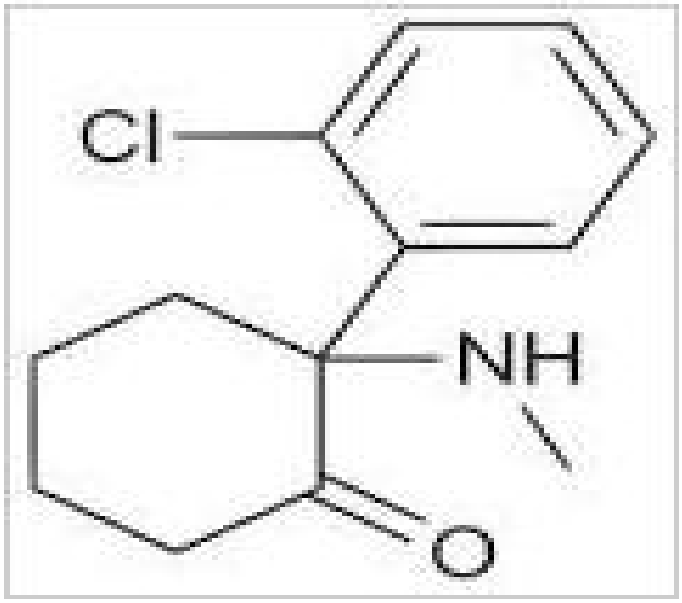
Further increase in plasma concentration depresses the CNS, leading to respiratory depression and respiratory arrest. CNS toxicity is followed by cardiovascular toxicity in adults.

There is also role of slow or flicker potassium channels in Levobupivacaine toxicity.

PHARMACOLOGY OF KETAMINE

Ketamine is an aryl cyclo hexyl amine, a congener of Phencyclidine. It is available as R+ and S- isomers. The S isomer form is more potent with fewer side effects.

It is readily water soluble even though it is lipophilic. It is available as sodium chloride solutions both with and without preservatives. Preservative used is benzethonium chloride.



PHARMACO KINETICS :

I V Induction dose – 1 – 2 mg / kg

pH – 3.5 – 5.5

Minimum hypnotic level – 1 micro gm/ ml

Induction dose duration – 10 – 15 mins

Half – life - 3 hours

Clearance - 19.1 ml / min / kg

Protein binding capacity – 27 %

Volume of distribution – 3.1 litre / kg

Distribution half life – 10 – 15 mins

Ketamine is metabolized in liver to nor ketamine,which has less CNS effects. It is further metabolised and excreted in bile and urine. It has rapid clearance and large volume of distribution . So it convenient to use it as continuous infusion.

It is typically administered intravenously but also effective by i.m, oral, rectal and epidural routes.

MECHANISM OF ACTION :

Ketamine predominantly inhibits excitatory neuro transmission at glutaminergic synapses. It inhibits the ligand gated cationic channel, the N – methyl D- aspartate [NMDA] receptor by binding to the phencyclidine site.

The NMDA receptors , glutamate gated cationic channels involved in long term modulation of synaptic responses and glutamate mediated neurotoxicity.

The thalamus relays sensory impulses from reticular activating system to cerebral cortex , ketamine functionally dissociates the thalamus in contrast to barbiturates.

EFFECT ON VARIOUS SYSTEMS :

CENTRAL NERVOUS SYSTEM:

Ketamine raises the intracranial blood pressure and increase the cerebral blood flow. It also increases the cerebral metabolic rate in anterior cingulate, frontal cortex, thalamus and putamen.

It is contraindicated in patients with intracranial pathology or cerebral ischemia as the S ketamine increases the CBF and ICP while R+ decreases CBF and ICP.

It also increases intraocular pressure thus it is not used in patient with open eye injury. It can cause emergence delirium, hallucinations, vivid dream and delusions. It rapidly produces a hypnotic state.

Patient remain unresponsive to commands and amnesia with profound analgesia, but they may moves their limbs, open their eyes involuntarily and have a spontaneous breathing.

It induces a cataleptic state which is accompanied by , salivation, lacrimation, spontaneous limb moments with increased muscle tone, nystagmus and pupillary dilatation This cataleptic state has been termed as Dissociative Anesthesia.

It reduces the development of tolerance to long term opioid use. So, low-dose ketamine infusion can be used in patient who have developed siginificant opioid tolerance.

CARDIOVASCULAR SYSTEM:

Ketamine has indirect sympathomimetic activity and it can be used in patient at risk of developing hypotension.

It indirectly inhibits both central and peripheral catcholamine reuptake, thus it increases BP, heart rate, cardiac output. It increases myocardial O2 consumption and thus it is not used for patient at risk for MI.

RESPIRATORY SYSTEM:

Induction dose produce small and transient decrease in minute ventilation but cause less severe respiratory depression. It is a potent bronchodilator due to indirect sympathomimetic activity and thus it is used in patients at risk for bronchospasm .

REVIEW OF LITERATURE

1.**Locatelli et al**[4] did a randomised study to evaluate the post op pain relief after lower abdominal surgery with adding ketamine 0.5 mg / kg allows a lower concentration of levobupivacaine in caudal block without loss of clinical effectiveness. 164 children [ASA 1 or 2] aged three months to 6 years randomly allocated to receive 1 ml / kg of levobupivacaine 0.15% with 0.5 mg / kg s(+) ketamine [group 1], levobupivacaine 0.175% with 0.5 mg / kg s (+) ketamine [group 2] or levobupivacaine 0.2 % [group 3] by caudal epidural route.

During the first 6 hours after surgery Pain, sedation, motor block and postoperative analgesia requirement were assessed. The effectiveness of the drugs showed no significant difference between groups at first surgical incision.

During the post operative period ,it was found that there was significant lower analgesic requirement in group 2 compared with group 3. First rescue analgesia time was found to be longer in group 2 in comparison to group 1 and 3.In ketamine groups , no dysphoric reaction or excessive sedation was observed in the ketamine groups.

2.Marhofer et al[5] did a prospective randomised study to evaluate the intra and post operative analgesic efficacy of preservative free s(+) ketamine compared with bupivacaine for caudal epidural block in paediatric hernia repair.

After induction , 49 children undergoing hernia repair were given, a caudal epidural injection (0.75 ml/kg) of s (+) ketamine 0.5 mg/kg [group k1] , s(+) ketamine 1mg/kg [group k2] or 0.25% bupivacaine with adrenaline 1: 200000 [group B].

There was no requirement of any additional analgesic drugs during operation in all the groups. During the observation period Haemodynamic status and respiratory variables was found to be stable.

In group B and k2 the mean duration of analgesia was found to be longer compared with group k1. The requirement for analgesics in the post operative period was found to be less in Groups k2 and B when compared with group k1 [30% and 33% Vs 72%,$p < 0.05$].

Post operative sedation scores of all the three groups were comparable. In conclusion of his study , he found that s(+) ketamine 1 mg/kg for caudal epidural block in paediatric surgical and post operative analgesia was found to be equivalent to that of bupivacaine.

3.**Martindale et al**[6] performed a randomized double blinded controlled trial of caudal Vs intravenous s(+) ketamine in children for lower abdominal surgery for supplementation of caudal analgesia.

60 children randomly allocated into three groups of children , group 1 received plain bupivacaine 0.25% 1ml/kg , group 2 received caudal plain bupivacaine 0.25% 1ml/kg with s(+) ketamine 0.5 mg /kg, group 3 received caudal plain bupivacaine 0.25 % 1ml/kg plus s(+) ketamine 0.5 mg/kg iv.

In group 2 [10 hours] those received caudal ketamine the median time to first analgesia was significantly longer than in the iv ketamine [4. 63 hours] or bupivacaine [4.75 hours] groups [p=0.01].

During the first 2 hours, it was found that less doses of analgesia were required for the caudal ketamine group [median 1] compared with iv ketamine [median 2] or bupivacaine [median 2.5] groups [$p<0.05$].

The groups showed no difference among themselves in the incidence of postoperative nausea , vomiting and psychomotor reactions.

4**. Ivani et al**[7] did a prospective , randomised double blinded study in caudal block for children[age of 1-7 yrs] who are] undergoing subumblical surgery, with three different concentration of levobupivacaine [0.125%, 0.20% and 0.25%, n=20 in each group.

The duration of postoperative analgesia was assessed as by the time taken for requirement for 1st administration of supplemental analgesia drugs [based on CHIPPS score of ->4] and the degree of immediate postoperative motor blockade, it was determined by use of a 3 point scale.

A dose response relationship was observed both with regard to median duration of the number of patient with evidence of duration of the number of patient with evidence of early post operative motor blockade [0.125%,0 ; 0.20%, 4; 0.25%,8] and post operative analgesia [0.125%,60 min,0.20%,118 mins, 0.25%, 158 mins].

The 0.125% concentration levobupivacaine was associate with significantly less early motor blockade [p=0.003] but was found to result in a significantly less duration of postoperative analgesia [p<0.05].

Based on these results , the use of 0.25% levobupivacaine might represent the best clinical option for caudal block if a plain levobupivacaine solution is to be used.

5. Pablo imgelmo et al[9] did prospective , randomised double blinded study to determine the minimum local analgesic concentrations of a caudal block single shot of ropivacaine and levobupivacaine in children and to describe the upper dose response curve .

It was performed in two phases. In phase 1, 80 children randomized to receive either levobupivacaine or ropivacaine. In 2nd phase , a further 32 patients were randomly allocated to receive caudal anaesthesia with doses designed to determine the upper dose response range [the 50% effective dose {ED 50}- ED95].

There was no significant difference in ED50 values for caudal levobupivacaine and ropivacaine. The ED50 for ropivacaine estimated from the Dixon Massey method was 0.075% and for levobupivacaine was 0.069%.

Estimated by isotonic regression, the ED50 and ED95 respectively of ropivacaine were 0.066[0.033 – 0.098] and 0.225. For levobupivacaine ED50 and ED95 were 0.068 and 0.20 %. There was no

significant differences in the ED50 for caudal ropivacaine and levobupivacaine. The potency ratio at ED50 was 0.92 and ED95 was 0.89, indicating that caudal levobupivacaine and ropivacaine have a similar potency.

6**. Cook B et al**[1], conducted a study in 60 boys aged 1-10 years undergoing orchidopexy , who were randomly allocated into three groups , comparing the effects of adrenaline 5 microgm/ml, clonidine 2 microgm/kg or ketamine (0.5 mg/kg) when added an adjuvant to 0.25% plain bupivacaine 1ml/kg.

Using modified objective pain score, Post operative pain was assessed. He found that the mean duration of analgesia was 12.5 hours, , 5.8 hours, and 3.2 hours in groups which received ketamine, clonidine and in the group which received adrenaline respectively.

It was found that there were no difference between the groups in the incidence of motor block, urinary retention or post operative sedation.

7.**Naqub et al**[8] performed a double blinded randomised study in children undergoing inguinal herniotomy to compare the analgesic

effects of bupivacaine 0.25% [1ml/kg] with or without ketamine 0.5 mg/kg.

They found no significant difference in the quality of analgesia between the groups. Only 7 % of patients who received the ketamine/ bupivacaine combination required further analgesia during the first 24 hours after surgery, compared with 20% and 50 % respectively of children in the ketamine only and bupivacaine only groups.

8**. Locatelli et al**[10] did a randomzised double blinded phase 3 control trial comparing levobupivacaine 0.25 % , ropivacaine 0.25% and bupivacaine 0.25% by the caudal route in children.

99 ASA 1 & 2 children <10 year old scheduled for elective lower abdominal surgery were randomised to receive caudal block with bupivacaine 0.25%, ropivacaine 0.25%, or levobupivacaine 0.25%.

There was no significant differences in the analgesia onset time of the caudal block. Bupivacaine produced a significant incidence of residual motor block [$p < 0.01$] at wake up and long duration of post operative analgesia. Compared with other groups [$p= 0.03$].

9. **Chalkeadis et al**[11] did a study to know the pharmacokinetics of levobupivacaine 0.25% following caudal administration in children

below 2 years of age. A open label phase 2 study was undertaken to examine the pharmacokinetics of levobupivacaine 0.25% , 2 mg/kg in 49 children below 2 years of age.

After single shot caudal epidural administration, plasma concentration of levobupivacaine were determined at interval upto 60 mins after caudal injection. Peak plasma concentration ranged between 0.41 and 2.12 micro gm/ml.

After the caudal epidural administration of levobupivacaine 2mg/kg in children < 2 years of age, peak plasma concentration was within the accepted safe range for levobupivacaine.

Time taken to attain peak plasma concentration varied and occurred later than 60 mins in some children , particularly those aged <3 months. Sampling in future pharmacokinetics studies in this age group should extend beyond 60 minutes.

10**. Kumar et al**[12] did a prospective randomized double blinded clinical study to compare the efficacy of ketamine [0.5 mg/kg] , midazolam [50 microgm/kg] and neostigmine [2 microgm/kg] co administered with bupivacainein caudal epidural anaesthesia for unilateral inguinal herniotomy surgery.

80 ASA 1 children aged 5 to 10 years posted for unilateral inguinal herniotomy were randomly allocated into 4 groups [n=20]. Duration of analgesia in the post operative period was longer for bupivacaine and neostigmine group and bupivacaine midazolam group compared to other groups.

MATERIAL & STUDY

The study was conducted with the approval of ethical committee and written informed consent of parents or guardian.

INCLUSION CRTERIA:

Age: 6months to 8 Year

ASA: 1 & 2

Surgery: Elective lower abdominal surgery

Duration: Less than 120 minutes

EXCLUSION CRITERIA:

Patient with suspected coagulopathy

Uncontrolled systemic disorders

Infection at the site of caudal block

Known allergic to study drugs

Patient with skeletal deformities

H/O developmental delay & Neurological disease

MATERIALS USED:

Laryngoscopes of various sizes

Bougie

Oropharyngeal airway

Drugs- Atropine, fentanyl, propofol, preservative free ketamine, levobupivacaine, distilled water, ringer lactate, sevoflurane and other emergency drugs

Monitors –ECG, NIBP, SPO2

2 cc, 5 cc 10 cc syringe

22G intravenous cannula.

Appropriate size LMA

Weighing machine

A randomized controlled study was done to compare caudal epidural analgesia with 1ml/kg of 0.25% levobupivacaine with 0.5mg/kg preservative free ketamine vs levobupivacaine alone.

The clinical study was conducted at institute of child health, anaesthesiology department between September 2012 and October 2012. Sixty children between age group 6month.. to 8 year scheduled for elective lower abdominal surgeries were randomly divided into two groups for study. The age and weight of each child was recorded. All the children had their last feed at about 3am in the morning.

GROUP L:

Received caudal epidural block with 1ml/kg of 0.25% levobupivacaine with 0.5mg/kg preservative free ketamine.

GROUP K:

Received caudal epidural block with 1ml/kg of 0.25% levobupivacaine alone.

All the operation were carried out under general anesthesia.

Intravenous line was secured with 22G iv cannula on to a vein on their dorsum of hand.

Premedication of injection fentanyl 2microgram/kg was administered. Anesthesia was induced in the theatre with titrated doses of injection propofol along with N2O, O2 50:50 with sevoflurane 1%.

Precordial stethoscope pulse oximeter, NIBP, ECG, SPO2 monitors were attached.

In appropriate size LMA was positioned in situ, bilateral air entry was checked and LMA was fixed, anesthesia was maintained with 67% N2O and 33% O2 and sevoflurane 1 to 2% using Jackson Rees modification of Ayre's Tpiece with spontaneous respiration.

After induction of general anastheisa, Group L children received caudal epidural block with 1ml/kg of 0.25% levobupivacaine with 0.5mg/kg preservative free ketamine and Group K children received caudal epidural block with 1ml/kg of 0.25% levobupivacaine alone using 23G needle. Intraoperatively ringer lactate solution was infused.

Heart rate,SPO2, BP were recorded at an interval of 5mins. Children were extubated in deep plane of anesthesia.

Children remained in the recovery room until they were fully awake and then shifted to the post operative ward. The children were assessed by the staff nurse who was not aware of group allocation.

Assessment of pain, sedation, pulse rate, BP, SPO2 and complication like nausea and vomiting, respiratory depression, urinary retention, etc., was done at 0,1/2,1,2,3,4,5,6,8,10,12 hrs post operatively.

Pain was assessed using FLACC pain scale and rescue analgesia of syrup paracetemol 15mg/kg given at pain score 4 or above.

Oral feeds were allowed after 6 hrs. All children were examined prior to discharge for clinical evaluation of neurological system.

Sedation was assessed using Ramsay sedation score as follows.

“Score	Clinical description
I	Anxious and agitated
II	Cooperative, oriented, tranquil
III	Respond only to verbal commands
IV	Asleep with brisk response to light stimuli
V	Asleep with sluggish response to stimuli
VI	Asleep without response stimuli”

OBSERVATION AND RESULTS

Statistical analysis was done using statistical package for social sciences [SPSS for windows , version 16]

This study is a prospective randomized double blinded study done to assess the effect of Preservative Free Ketamine with Levobupivacaine for Caudal Block in Lower Abdominal Surgeries in Children. It was conducted on 60 children admitted for lower abdominal surgery at the Institute of child health, a tertiary hospital.

The primary outcome was measured as time duration of post operative analgesia and the secondary outcome was measured by haemodynamic changes [heart rate , blood pressure] in intra operative and post operative period.

The following observations were made. The quantitative data are expressed as mean (standard deviation) and median and the qualitative data as frequency.

The significant difference between two anaesthetic groups was found using Independent Sample T Test (Unpaired Student T Test) for quantitative data like age, weight, intra operative and post operative

Blood Pressure, intra operative and post operative Pulse rate and duration of rescue analgesia. Mann Whitney U Test was used for ordinal data like post operative FLACC pain score and post-operative Ramsay Sedation Scale.

Qualitative data like type of surgery, post operative complications were analysed using chi square and fisher's exact test wherever appropriate.

Table No 1: Age distribution of the studied population:

Age distribution	**Number of children**	**%**
<2	9	15.0
2-4	22	36.7
4-6	12	20.0
>6	17	28.3
Total	60	100.0

The above table shows that about one third (36.7%) of the children fall under age group between 2 to 4 where as about half (48.3%) are older than 4 years of age.

Figure 1: Age distribution of the studied population

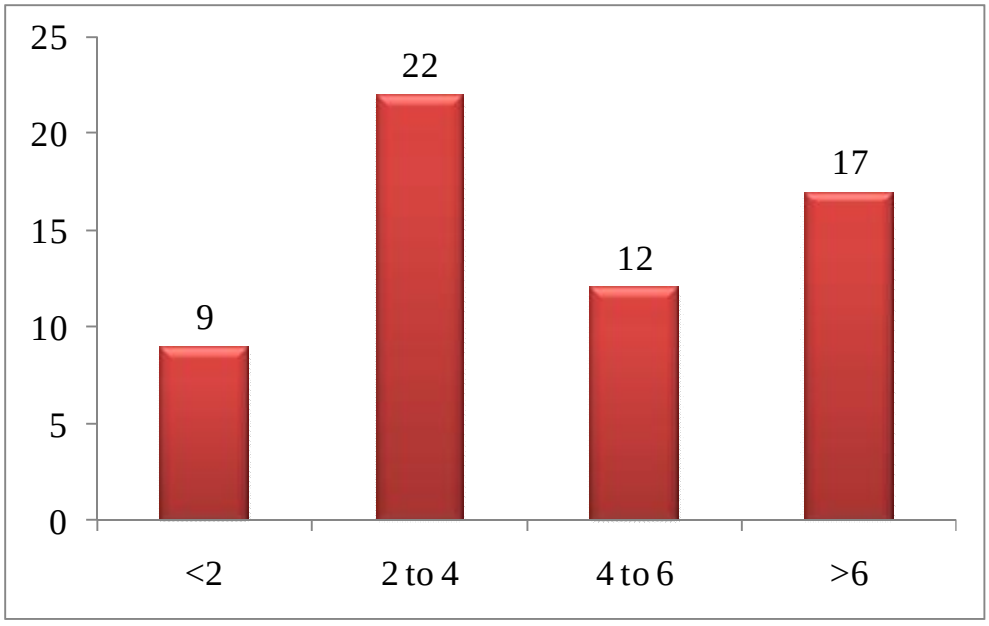


Table No 2: Gender wise distribution of the studied population:

Gender	Frequency	%
Females	3	5.0
Males	57	95.0
Total	60	100.0

Most of the studied children are males (95%) while female children contributed only 5% to the study.

Figure No 2: Gender wise distribution of the studied population

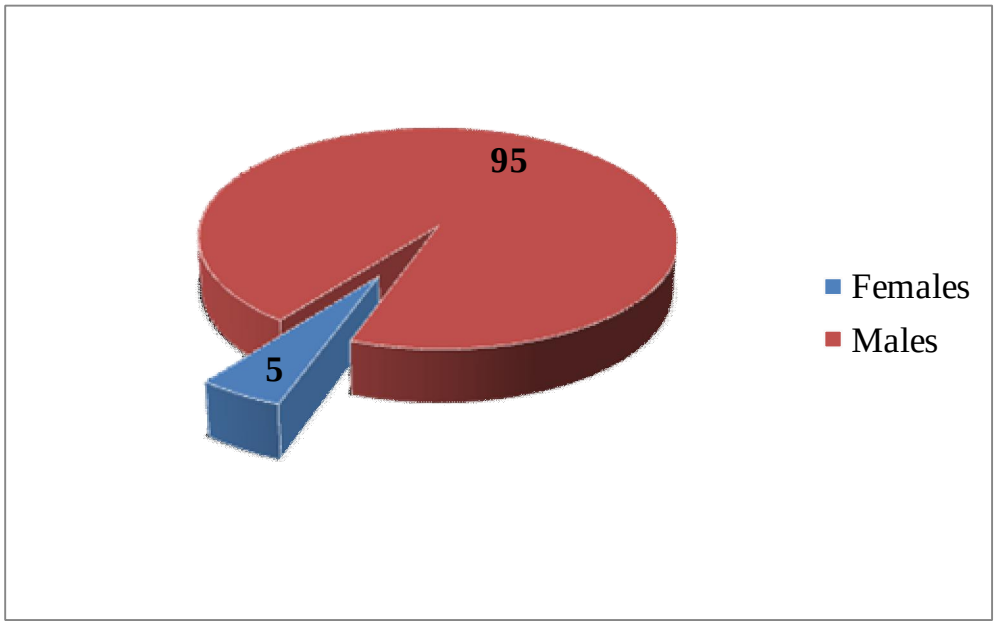


Table No 3: Baseline characteristics

Characteristics	Mean	Std Deviation
Age	3.925	2.174
Weight	13	4

The mean (Std Deviation) of the baseline characteristics age and weight are 3.925 (2.174) and 13 (4) respectively.

Table No 4: Type of Surgery performed:

Surgery	Frequency	Percent
Hydrocele	31	51.7
Inguinal Hernia	29	48.3
Total	60	100.0

Half of the surgery was performed for Congenital Hydrocoele (51.7%) and the other half for Inguinal Hernia repair (48.3%)

Figure No 4: Type of Surgery performed

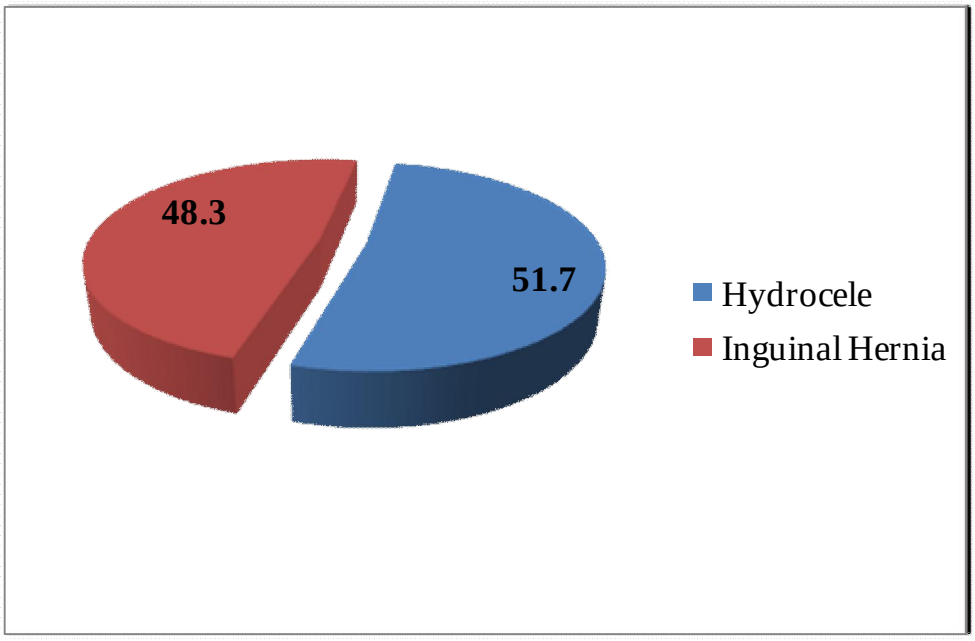


Table No 5: Post operative complications observed in the patients:

Complications	Frequency	Percent
None	49	81.7
Urinary retention	6	10.0
Both nausea and vomiting	5	8.3
Total	60	100.0

In 81.7% of the patients no post operative complications were observed while urinary retention was observed in 10% of the patients and the remaining 8.3% complained of both nausea and vomiting.

Figure No 5: Post operative complications observed in the patients

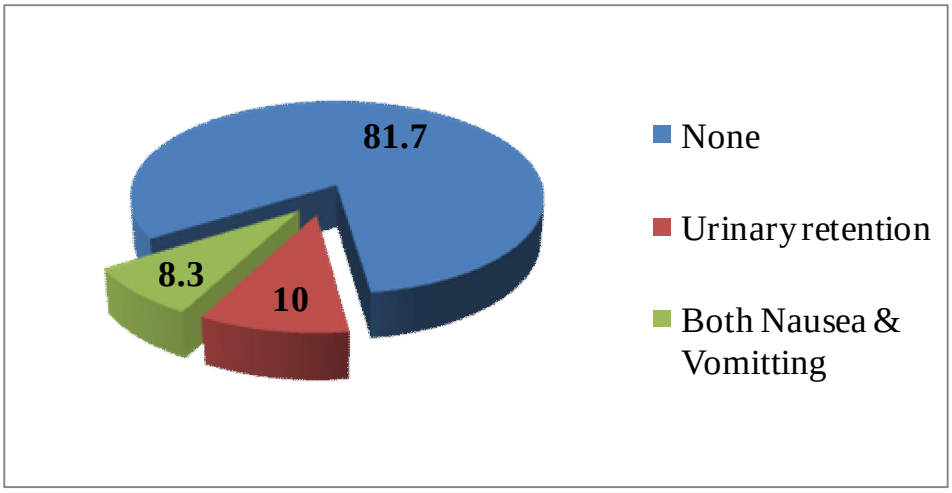


Table No 6: Patient characteristics – Age

(Independent Samples *t*Test).

Group	N	Mean	Std. Deviation	*T*	*p* value	95% Confidence Interval	
						Lower	Upper
Levobupivacaine	30	3.200	1.8551	-2.719	.009	-2.5174	-.3826
Ketamine	30	4.650	2.2558				

Table No 7: Patient characteristics – Weight

(Independent Samples Test).

Group	N	Mean	Std. Deviation	T	*p* value	95% Confidence Interval	
						Lower	Upper
Levobupivacaine	30	11.9000	3.69856	-2.408	.019	-3.96804	-.36529
Ketamine	30	14.0667	3.25823				

Both were comparable with respect to their age and weight characteristics. The *t* test reveals a statistically reliable difference between the mean age of children belonging to Levobupivacaine group (M= 3.2, s.d= 1.8551) and ketamine group (M=4.650, s.d= 2.258), *t*=2.719, *p*= 0.009, α=0.05.

It also reveals a statistically reliable difference between the mean weight of children belonging to Levobupivacaine group (M= 11.9, s.d= 3.658) and ketamine group (M=14.06, s.d=3.258), *t*=2.408, *p*= 0.019, α=0.05.

Figure No 6: Patient characteristics – Age and Weight

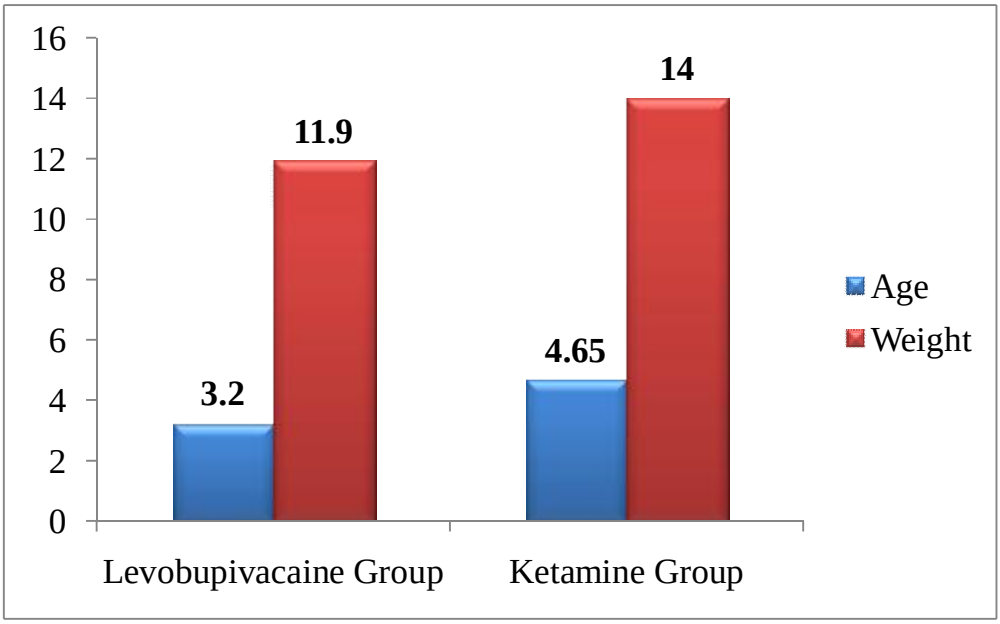


Table No 8: Patient characteristics – Duration of surgery

(Independent Samples Test).

Group	**N**	**Mean**	**Std. Deviation**	**T**	***p* value**	**95% Confidence Interval**	
						Lower	Upper
Levobupivacaine	30	29.83	9.603	-1.806	.076	-10.895	.561
Ketamine	30	35.00	12.387				

The mean (S.D) of the duration of surgery for Levobupivacaine and Ketamine group are 29.83 (9.603) and 35.00 (12.387) respectively. The *t-test* failed to reveal a statistically reliable difference in the mean duration of surgery between the 2 groups.

Table No 9: Patient characteristics – Gender

Gender	Ketamine	Levobupivacaine	Total
Females	1(33.33) {3.33}	2(67.33) {6.67}	3 (100) {5}
Males	29(50.87) {96.33}	28 (49.13) {93.33}	57 (100) {95}
Total	30 (50) {100}	30 (50) {100}	60 (100) {100}
Fisher's Exact Test: 1.000			

p.s: () – indicates row percentage; {} – indicates column percentage

The above table shows that the two different anaesthesia was equally given among males whereas one third (33.33%) of the females were given ketamine group of anaesthesia.There is no statistically significant relation between the Gender of the studied subjects and the type of anaesthesia given. (*p*= 1.00)

Figure No 7: Patient characteristics – Gender

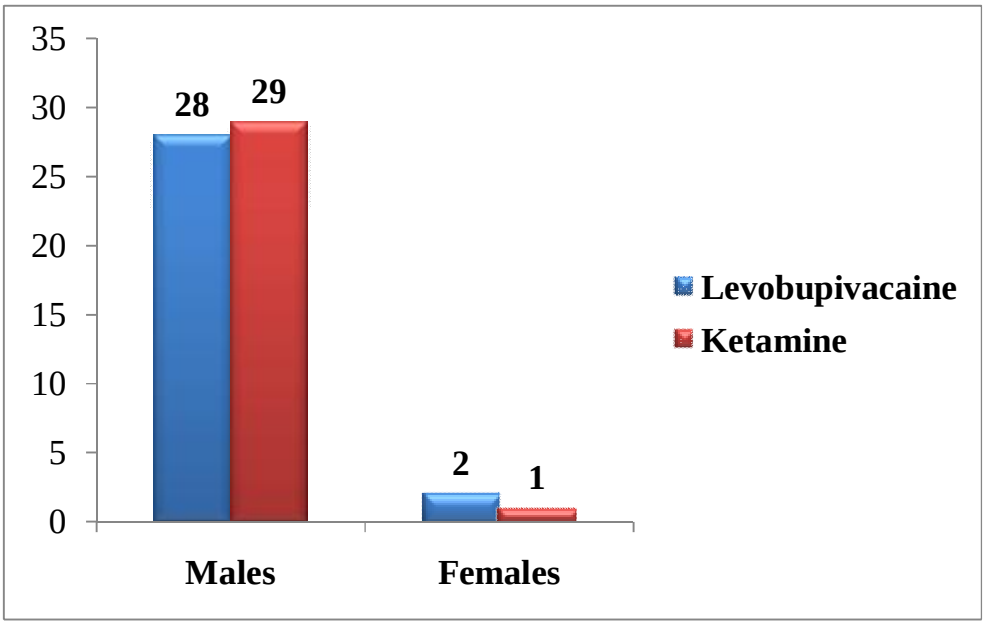


Table No 10: Post operative complications observed with the two groups of anaesthesia

Post Op Complications		**L**	**K**	**Total**
Present	Urinary retention	3	3	6
	Both Nausea &Vomitting	1	4	5
	Total	**4 (36.36) {13.33}**	**7 (63.64) {23.33}**	**11 (100) {18.33}**
Absent		26 (53.06) {86.67}	23 (46.94) {76.67}	49 (100) {91.67}
Total		**30 (50) {100}**	**30 (50) {100}**	**60 (100) {100}**
Fisher's Exact Test: 0.5602				

p.s: () – indicates row percentage; {} – indicates column percentage

One fifth (18.33%) of the children experienced post operative complications and among them nearly two third (63.64%) children were administered ketamine group of anaesthesia intra operatively. Fisher's exact test didn't reveal any statistically significant relation between the type of anaesthesia with the occurrence of post operative complications.

Figure No 8: Post operative complications observed with the two groups of anaesthesia

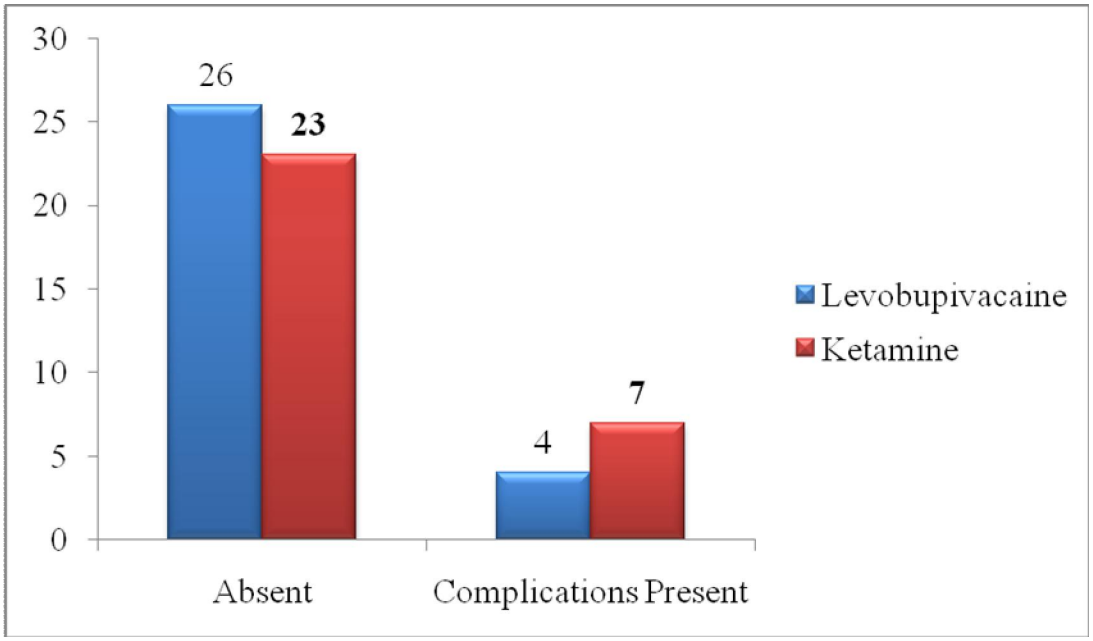


Table No 11: Intra operative MAP (Independent Samples Test).

Time	Group	N	Mean	Std. Deviation	T	*p* value	95% Confidence Interval	
							Lower	Upper
O min	Levobupivacaine	30	73.9556	6.96611	-1.953	.056	-9.40466	.11578
	Ketamine	30	78.6000	11.00588				
5 min	Levobupivacaine	30	68.7000	7.79839	-1.172	.246	-8.09467	2.11689
	Ketamine	30	71.6889	11.59169				
10 min	Levobupivacaine	30	68.6333	6.06248	-.698	.488	-5.19905	2.51016
	Ketamine	30	69.9778	8.63075				
15 min	Levobupivacaine	30	67.0222	4.86203	-.952	.345	-5.34246	1.89802
	Ketamine	30	68.7444	8.63064				
20 min	Levobupivacaine	30	65.4889	4.70651	-.990	.326	-5.33778	1.80444
	Ketamine	30	67.2556	8.56335				
25 min	Levobupivacaine	22	63.8788	5.26800	-1.412	.165	-6.41898	1.12527
	Ketamine	26	66.5256	7.32738				
30 min	Levobupivacaine	15	63.7333	5.72962	-1.235	.225	-7.04602	1.71903
	Ketamine	21	66.3968	6.79675				

35 min	Levobupivacaine	11	62.3030	5.55669	-2.519	**.019**	-11.28583	-1.10811
	Ketamine	14	68.5000	6.49622				
40 min	Levobupivacaine	5	61.0667	8.22733	-1.969	.071	-15.02855	.69522
	Ketamine	10	68.2333	5.80347				
45 min	Levobupivacaine	3	57.7778	2.77555	-2.796	**.023**	-17.08914	-1.64102
	Ketamine	7	67.1429	5.37090				
60 min	Levobupivacaine	1	55.3333		-3.189	**.050**	-17.98046	-.01954
	Ketamine	4	64.3333	2.52396				

The above table shows that the mean intra operative Mean Arterial Pressure (MAP) measured was higher in the Ketamine anaesthesia group both before the surgery and also at all times in the intra operative period. The *t* test revealed statistically significant difference in the mean intra operative Mean Arterial Pressure (MAP) between the Levobupivacaine group and the ketamine group measured at 35 min (p=0.019), 45 min (p=0.023) and 60 min (p=0.050).

Figure No 9: Intra operative MAP.

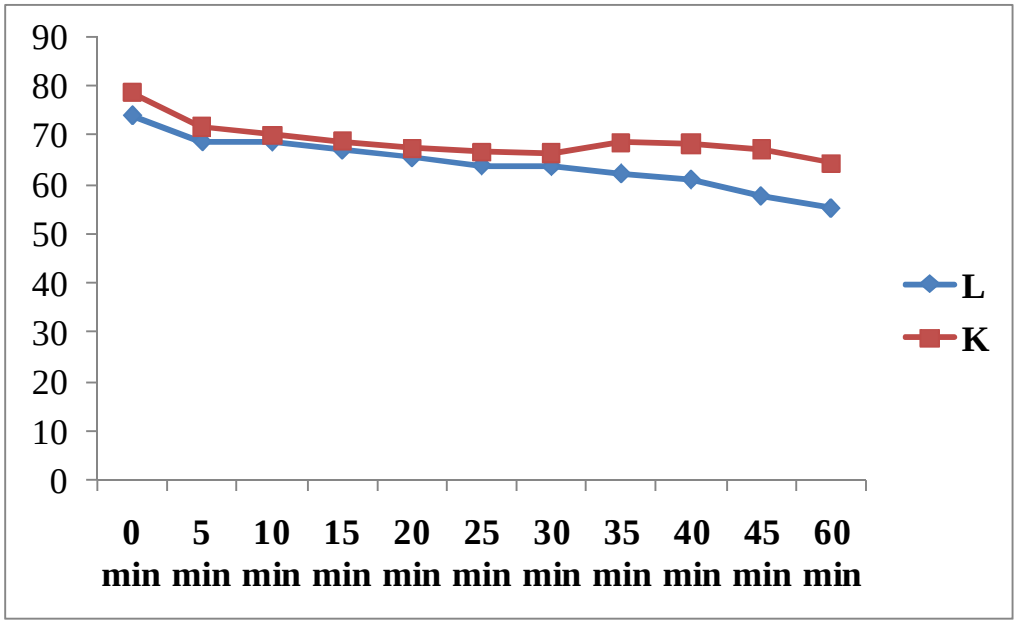


Table No 12: Intra operative PR (Independent Samples*t* Test).

Time	Group	N	Mean	Std. Deviation	t	*p* value	95% Confidence Interval	
							Lower	Upper
O min	Levobupivacaine	30	123.60	11.236	4.863	.000	8.276	19.857
	Ketamine	30	109.53	11.172				
5 min	Levobupivacaine	30	122.20	9.423	-.523	.603	-85.924	50.324
	Ketamine	30	140.00	186.167				
10 min	Levobupivacaine	30	115.77	10.074	3.640	.001	4.636	15.964
	Ketamine	30	105.47	11.779				
15 min	Levobupivacaine	30	112.30	9.037	3.848	.000	4.830	15.303
	Ketamine	30	102.23	11.119				
20 min	Levobupivacaine	30	108.83	8.363	3.839	.000	4.611	14.656
	Ketamine	30	99.20	10.905				
25 min	Levobupivacaine	22	106.00	8.000	2.441	.019	1.241	12.913
	Ketamine	26	98.92	11.426				
30 min	Levobupivacaine	15	103.53	8.935	1.645	.109	-1.525	14.497
	Ketamine	21	97.05	13.238				

35 min	Levobupivacaine	11	102.36	8.958	.814	.424	-5.840	13.425
	Ketamine	14	98.57	13.213				
40 min	Levobupivacaine	5	97.40	11.216	-.075	.941	-14.836	13.836
	Ketamine	10	97.90	12.494				
45 min	Levobupivacaine	3	93.00	6.083	-.580	.578	-17.779	10.636
	Ketamine	7	96.57	9.693				
60 min	Levobupivacaine	1	92.00	.	-.299	.785	-52.457	43.457
	Ketamine	4	96.50	13.478				

The mean Pulse rate was lower in the ketamine group before the surgery and also between 10^{th} min to 35^{th} min of surgery whereas at other times the Pulse rate Levobupivacaine group was higher.

The *t* test revealed a statistically significant difference in the mean pulse rate between the two groups at the commencement of surgery 0 min (p= 0.000), 10 min (p= 0.001), 15 min (p= 0.000), 20 min (p= 0.000), 25 (p= 0.019).

Figure No 10: Intra operative PR

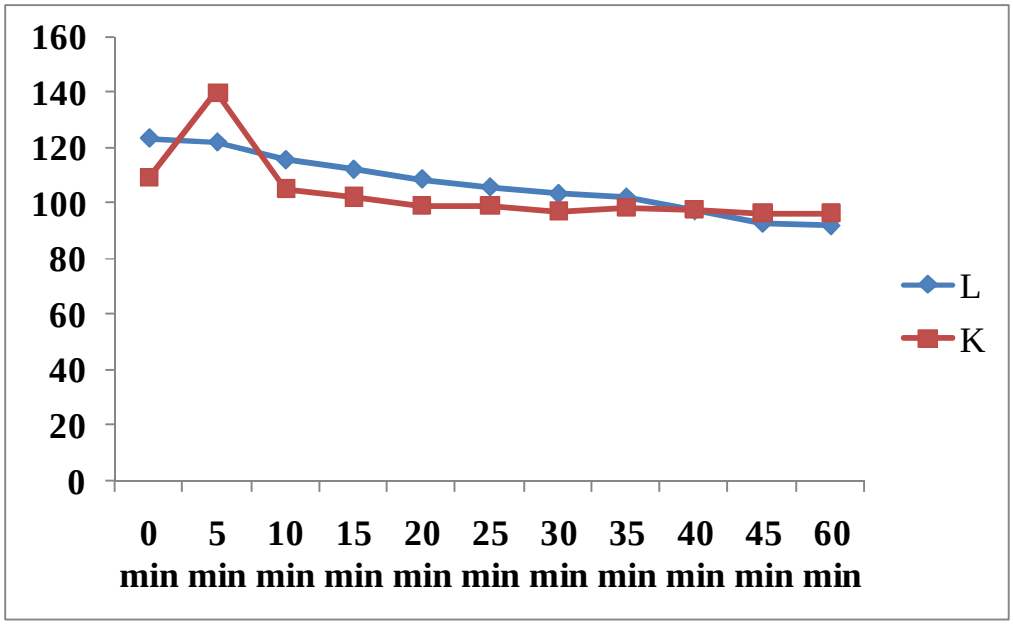


Table No 13: Post-operative MAP (Independent Samples *t*Test).

Time	Group	N	Mean	Std. Deviation	t	*p* value	95% Confidence Interval	
							Lower	Upper
30 min	Levobupivacaine	30	64.1333	4.47608	-1.971	.054	-5.64366	.04366
	Ketamine	30	66.9333	6.36465				
1 Hr	Levobupivacaine	30	64.3111	4.26600	-2.124	.038	-5.58965	-.16591
	Ketamine	30	67.1889	6.07153				
2 Hr	Levobupivacaine	30	65.3000	3.83106	-2.243	.029	-5.27814	-.29964
	Ketamine	30	68.0889	5.63169				
3 Hr	Levobupivacaine	30	66.5111	4.04452	-1.977	.053	-4.91930	.03041
	Ketamine	30	68.9556	5.43138				
4 Hr	Levobupivacaine	30	67.8111	4.45985	-1.733	.088	-4.81326	.34660
	Ketamine	30	70.0444	5.47214				
5 Hr	Levobupivacaine	28	68.9524	4.82766	-1.438	.156	-4.79299	.78665
	Ketamine	30	70.9556	5.70456				
6 Hr	Levobupivacaine	19	70.1228	5.41854	-1.290	.203	-5.34578	1.16917
	Ketamine	30	72.2111	5.58630				
8 Hr	Levobupivacaine	7	70.7143	7.21220	-1.199	.238	-7.97979	2.05281
	Ketamine	30	73.6778	5.57326				

This table on the mean post-operative Mean Arterial Pressure (MAP) shows that children subjected to ketamine anaesthesia had an higher MAP compared with the other Levobupivacaine group throughout the post-operative period.

The independent samples *t* test revealed a statistically significant difference in the mean Mean Arterial Pressure (MAP) measured in the 1st (p=0.038) and 2nd (p=0.029) hour in the post-operative period.

Figure No 11: Post-operative MAP

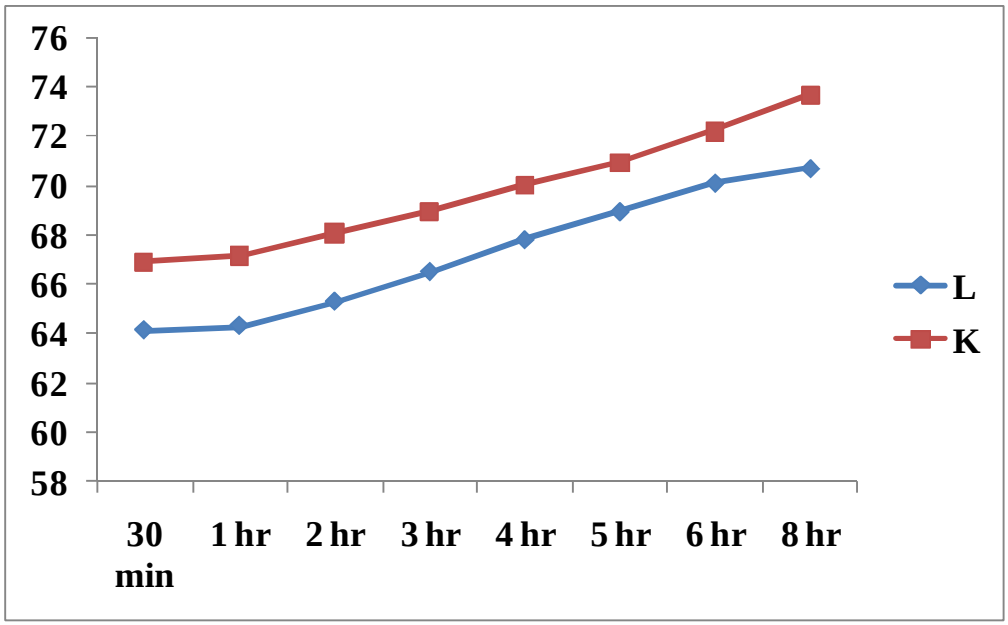


Table No 14: Post operativePR (Independent Samples Test).

Time	Group	N	Mean	Std. Deviation	T	*p* value	95% Confidence Interval	
							Lower	Upper
30 min	Levobupivacaine	30	106.07	8.047	2.819	.007	2.096	12.370
	Ketamine	30	98.83	11.525				
1 Hr	Levobupivacaine	30	104.60	7.351	3.145	.003	2.677	12.056
	Ketamine	30	97.23	10.517				
2 Hr	Levobupivacaine	30	104.03	6.646	2.891	.005	2.062	11.338
	Ketamine	30	97.33	10.813				
3 Hr	Levobupivacaine	30	105.03	7.209	3.240	.002	2.662	11.271
	Ketamine	30	98.07	9.314				
4 Hr	Levobupivacaine	30	107.67	8.949	3.713	.000	4.025	13.441
	Ketamine	30	98.93	9.266				
5 Hr	Levobupivacaine	28	109.07	8.326	3.882	.000	4.358	13.651
	Ketamine	30	100.07	9.270				
6 Hr	Levobupivacaine	19	111.74	7.600	3.926	.000	4.927	15.280
	Ketamine	30	101.63	9.434				
8 Hr	Levobupivacaine	7	113.86	9.388	2.743	.010	2.578	17.269
	Ketamine	30	103.93	8.452				

The mean post-operative pulse rate was lower with the ketamine group anaesthesia administered children than the other group.

The t-test showed a statistically significant difference in the pulse rate measured throughout the post-operative period at 30 min (p=0.007), 1stHr (p=0.003), 2ndHr (p=0.005), 3rdHr (p=0.002), 4thHr (p=0.000), 5thHr (p=0.000), 6thHr (p=0.000) and 8thhr (p=0.010).

Figure No 12: Post operative PR

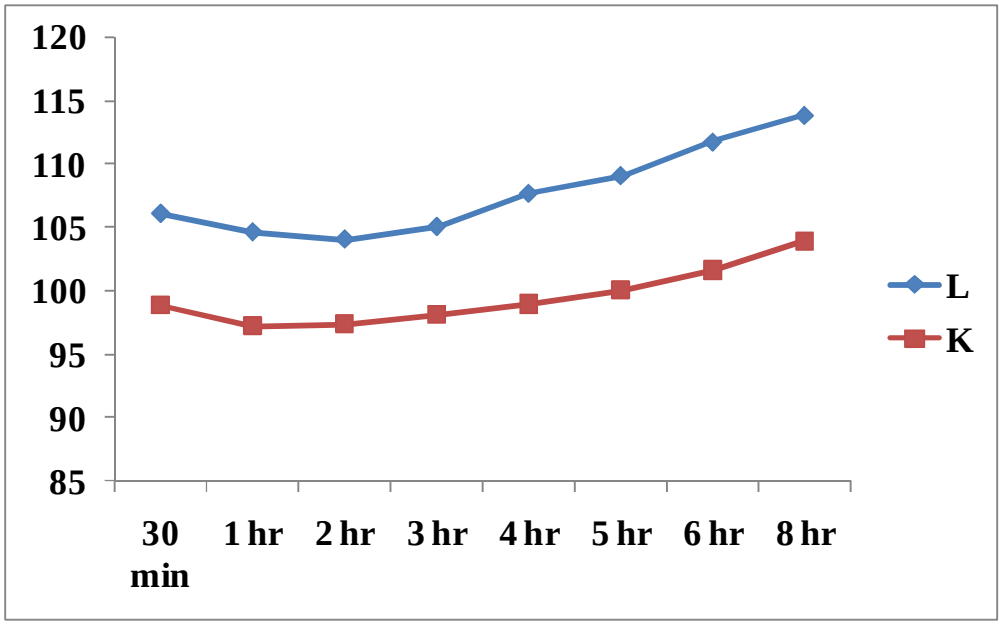


Table No 15: Post operative FLACC pain score (Mann-Whitney Test).

Time	Group	N	Mean Rank	Mann-Whitney Test	*P*value
30 min	Levobupivacaine	30	30.50	450	1.00
	Ketamine	30	30.50		
1 Hr	Levobupivacaine	30	30.50	450	1.00
	Ketamine	30	30.50		
2 Hr	Levobupivacaine	30	30.50	450	1.00
	Ketamine	30	30.50		
3 Hr	Levobupivacaine	30	31.50	420	0.154
	Ketamine	30	29.50		
4 Hr	Levobupivacaine	30	41.00	135	0.000
	Ketamine	30	20.00		
5 Hr	Levobupivacaine	28	43.96	15	0.000
	Ketamine	30	16.00		
6 Hr	Levobupivacaine	19	39.63	7.0	0.000
	Ketamine	30	18.75		
8 Hr	Levobupivacaine	7	33.00	7.0	0.000
	Ketamine	30	15.73		

The assessment of the children's pain level through non verbal scale such as the FLACC pain scale showed that both group of anaesthesia had a similar post operative pain relief in the immediate 2 hours after surgery.

The ketamine group of anaesthesia showed a decrease in the mean rank of FLACC pain score scale after the 2^{nd} hour till the end of observation period.

From this data it can be concluded that there is a statistically significant difference between the Levobupivacaine and the ketamine group's median FLACC pain score in the post operative period at 4^{th}Hr (U=135, p=0.000), 5^{th}Hr (U=15, p=0.000), 6^{th}Hr (U=97.5, p=0.000) and 8^{th}Hr (U=7, p=0.000).

It can be further concluded that the ketamine administered children elicited statistically significant lower FLACC pain score than the Levobupivacaine administered group.

Figure No 13: Post operative FLACC pain score

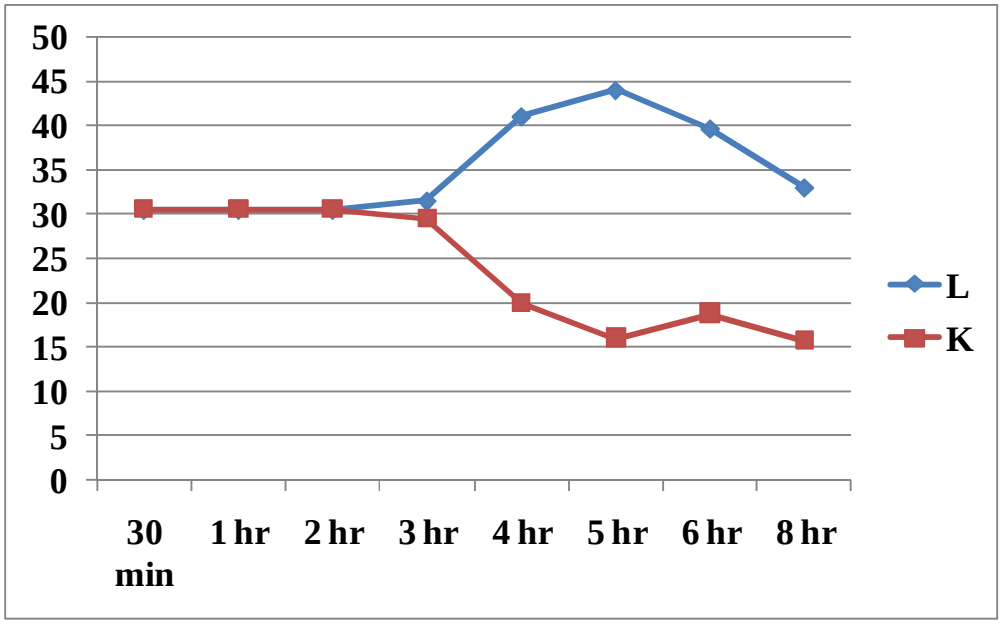


Table No 16: Post operative Ramsay Sedation Scale (Mann-Whitney Test).

Time	Group	N	Mean Rank	Mann-Whitney Test	*P*value
30 min	Levobupivacaine	30	31.5	420	0.305
	Ketamine	30	29.5		
1 Hr	Levobupivacaine	30	28	375	0.198
	Ketamine	30	33		
2 Hr	Levobupivacaine	30	24.3	264	0.001
	Ketamine	30	36.7		
3 Hr	Levobupivacaine	30	23.3	234	0.000
	Ketamine	30	37.7		
4 Hr	Levobupivacaine	30	22.23	202	0.000
	Ketamine	30	38.77		
5 Hr	Levobupivacaine	28	19.45	138.5	0.000
	Ketamine	30	38.88		
6 Hr	Levobupivacaine	19	14.79	91	0.000
	Ketamine	30	31.47		
8 Hr	Levobupivacaine	7	5.00	7	0.000
	Ketamine	30	22.27		

The above table shows that the Ramsay Sedation Scale in the post operative period. In the 1st 30 min the Levobupivacaine group showed a higher Ramsay sedation scale score than the Ketamine group but there was no significant difference in their median Ramsay Sedation scale score (U=420, p=0.305).

Further measurement showed that the ketamine group had a greater Ramsay Sedation Scale Score at 1st, 2nd, 3rd, 4th 5th, 6th and 8thhr of post operative period.

It can also be seen that statistically significant difference between the Levobupivacaine and ketamine group's median Ramsay Sedation Scale score in the 2ndHr(U=264, p=0.001), 3rdHr(U=234, p=0.000), 4thHr(U=202, p=0.000), 5thHr(U=138.5, p=0.000), 6thHr(U=91, p=0.000) and 8thHr(U=7, p=0.000).

It can be also stated that Ketamine administered group had a statistically significant higher Ramsay Sedation Scale score after the 2nd hour in the post operative period as compared with the Levobupivacaine group.

Figure No 14: Post-operative Ramsay Sedation Scale

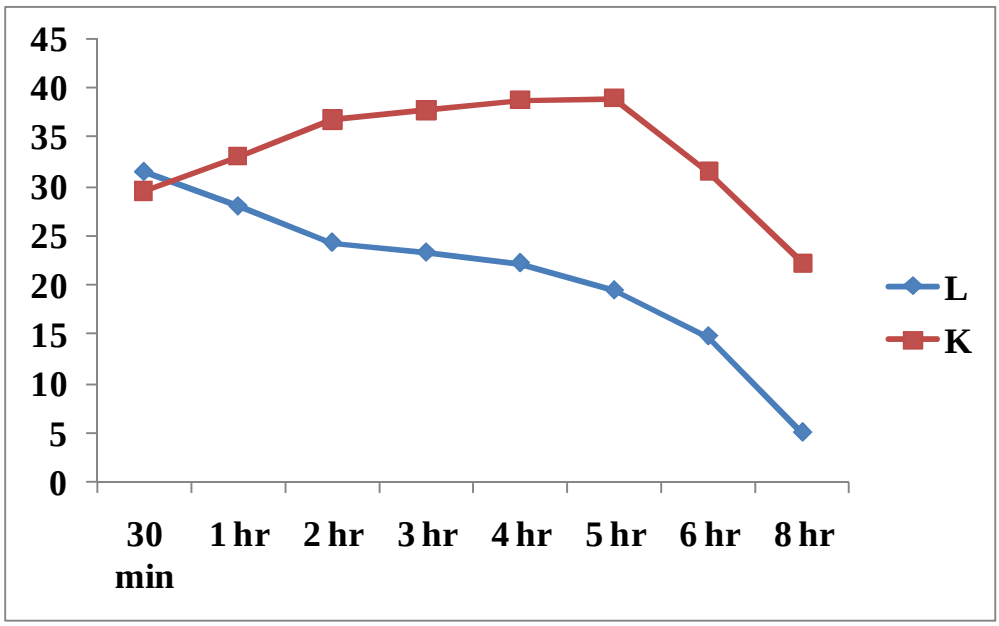


Table No 17: Duration of analgesia (Independent Samples Test).

Group	N	Mean	Std. Deviation	T	*p* value	95% Confidence Interval	
						Lower	Upper
Levobupivacaine	30	5.93	1.015	-15.206	.000	-5.055	-3.879
Ketamine	30	10.40	1.248				

This table shows the mean duration of analgesia action exerted by the two groups of anaesthetic agents. It can be seen that the mean duration of analgesia is greater in the Ketamine group {m= 10.40 (1.248)} than the Levobupivacaine group {m= 5.93 (1.015)}.

A *t* test reveals a statistically significant difference between the mean duration of analgesia of the ketamine group and the Levobupivacaine group. ($t = 15.206$, $p = 0.000$, $\alpha = 0.05$)

DISCUSSION

Caudal epidural anaesthesia is an effective means of providing post operative analgesia in children. In this study, I found that addition of ketamine in the of 0.5 mg/kg with 0.25 % of levobupivacaine 1ml/kg increases the duration of post operative analgesia **.**

Locatelli[4] observed caudal block with levobupivacaine and ketamine gives longer analgesia than caudal block with levobupivacaine alone.

The main disadvantage of caudal anaesthesia is the short duration of action after a single injection of local anaesthetic solution. Even long acting local anaesthetic drugs such as bupivacaine provide only 4 – 8 hours of analgesia.

The use of caudal catheters for administering repeated doses or infusion of local anaesthetic solution is not popular because of concerns about infection. Prolongation of caudal analgesia using a single shot technique have been achieved by the addition of various adjuvants.

Caudal epidural anaesthesia provide good postoperative analgesia. Thus it reduces general anaesthesia's requirement and providing a smooth pain free awakening.

It diminishes the potential risk associated with deeper planes of anaesthesia. In short cases, it can help to avoid airway instrumentation. It provides faster and comfortable wake up times in the operating room, quicker discharge and thus faster turn around time in the post anaesthetic care unit.

It provide optimal postoperative analgesia as a part of a balanced multimodal approach to pain management, which includes paracetamol, non pharmacological support and occasionally opiod.

Even a single dose of opioid can cause vomiting and respiratory depression, it should be avoided as much as possible .Thus, regional blocks can reduce the incidence of vomiting. It reduces undesirable reflexes associated with the anal sphincter and testis which can cause laryngospasm.

In this study, I have used ketamine at a lower dose of 0.5 mg/kg in addition to levobupivacaine for caudal epidural block in order to avoid systemic side effects. Intravenous analgesic dose of ketamine is more than caudal dose. In addition , it has lesser duration of action and comparatively more side effects.

LIMITATIONS OF CAUDAL USE OF KETAMINE :

It is preferable to use it as additive to local anaesthetic because it needs to be used in higher dose to make to act as a sole anaesthetic. In case if it is used solely , risk of systemic toxicity is more because of more systemic absorbtion.

Its usage is restricted as single shot bolus only, because continuous infusion through an epidural catheter is not advisable since it produces damage to neural tissue.

Some investigators blame the preservatives like benzethonium chloride and chlorbutanol, used in ketamine for producing neuro toxicity. So it is better to use preservative free ketamine whenever possible.

In this study. I found that duration of postoperative analgesia in ketamine group was prolonged .The mean duration of post operative analgesia in 'k' group was 10.40 and that of 'L' group was 5.93 . The 'P' value is<0.05.

These finding were similar to the results of another study done by **cook and colleagues**[1] which reports that addition of ketamine 0.5mg/kg to bupivacaine 0.25% (1 ml/kg) provides longer mean

duration of postoperative analgesia after orchidopexy [12.5 hrs] than clonidine 2 micro gm/ kg [5.8 hrs , $p < 0.05$] or epinephrine 5 micro gm / ml [3.2 hrs, $p<0.001$].

Naquib and collegues[8] compared the analgesic effect of bupivacaine 0.25% [1ml/kg] with and without ketamine 0.5 mg/kg in children undergoing herniotomy. Although there was no significant difference in the quality of analgesia , only 7 % of patients who received the ketamine and bupivacaine combination required any further analgesia in the first 24 hrs after surgery, compared with 20% and 50% respectively of children who received ketamine and bupivacaine only groups.

SUMMARY

From this prospective double blinded study conducted on 60 patients who underwent elective lower abdominal surgery, we tried to evaluate the effect of the preservative free ketamine on the duration of analgesia and intra operative and post operative hemodynamics when used with levobupivacaine for caudal epidural block. The summary of our findings are

1. It can be seen that the mean duration of analgesia is greater in the Ketamine group {m= 10.40 (1.248)} than the Levobupivacaine group {m= 5.93 (1.015)} which was found to be statistically significant.

2. Post operative FLACC pain score and Ramsay sedation scale is comparable between both groups upto 2 hours. After that, there is significant difference between both groups[p value < 0.05].

3. In both the groups , haemodynamic changes in intra operative and post operative period were comparable and insignificant.

CONCLUSION

From our study we conclude that administration of preservative free ketamine with levobupivacaine in caudal epidural block increases the duration of post operative analgesia without significantly altering the hemodynamics compared with levobupivacaine alone. Thus low dose preservative free ketamine can be used as additive to local anaesthetics in caudal epidural anaesthesia for prolonging analgesic effect.

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PROFORMA

Date: Roll no: Group

Name: Age/Sex: IP no:

Wt:

Diagnosis:

Surgical Procedure done:

Pre op assessment:

History:

Any H/O co-morbid illness

Any H/O previous surgery

O/E: CVS: RS:

BP: PR: SPO2:

ASA status:

Drugs used:

Induction:

Maintenance:

Time of administration of caudal block:

Duration of surgery:

Intra OP events:

Time	Events	HR	BP	SPO2

Post OP events

Time(Hrs)	HR	BP	Pain Score	Sedation Score

Complication:

Group	Respiratory Depression	Apnea	Pruitis	Urinary Retention	Nausea & Vomiting

INFORMATION TO PARTICIPANTS FORM

Investigator **:** Dr.S.SARAVANAN

Name of the Participant:

Title: "Effect of Preservative Free Ketamine with Levobupivacaine for Caudal Block in Lower Abdominal Surgeries in Children "

Your child are invited to take part in this research study. We have got approval from the IEC. Your child are asked to participate because he satisfy the eligibility criteria .We want to study the benefits of preservative free ketamine with levobupivacaine for caudal block.

What is the Purpose of the Research:

Compares the efficacy and safety of caudal epidural administration of preservative free ketamine with levobupivacaine vs levobupivacaine alone.

The Study Design:

All the patients are randomly allocated into two groups.

Benefits:

Systemic side effects of ketamine avoided, increased duration of post-operative pain relief.

Discomforts and risks:

Hypotension and allergic to levobupivacaine in rare patients can occur. These can be promptly recognised and treatable.

This intervention has been shown to be well tolerated as shown by previous studies. And if you do not want to participate your child will have alternative of setting the standard treatment and your safety is our prime concern.

Time :
Date :
Place : Signature / Thumb Impression of parent

Signature of the Investigator : _____

Name of the Investigator : _____

ETHICAL COMMITTEE CERTIFICATE OF APPROVAL

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr.S.Saravanan
PG in M.D.Anaesthesiology
Madras Medical College & Rajiv Gandhi Government General Hospital,
Chennai -3

Dear Dr. S.Saravanan,

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled " Effect of preservative free Ketamine with levobupivacaine for caudal block in lower abdominal surgeries in children" No.05112012.

The following members of Ethics Committee were present in the meeting held on 01.11.2012 conducted at Madras Medical College, Chennai -3.

1. Prof. R. Nandhini MD Director, Instt. of Pharmacology ,MMC, Ch-3	-- Member Secretary
2. Prof. Reghu MD Director , Inst. Of Internal Medicine, MMC, Ch-3	-- Member
3. Prof. Shyamraj MD Director i/c , Instt. of Biochemistry , MMC, Ch-3	-- Member
4. Prof. P. Karkuzhali. MD Prof., Instt. of Pathology, MMC, Ch-3	-- Member
5. Prof. G.Muralidharan MS Prof of Surgery, MMC, Ch-3	-- Member
6. Thiru. S. Govindsamy. BA, BL	-- Lawyer

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

R Nandhini 19/11/12
Member Secretary, Ethics Committee

MASTER CHART

KETAMINE GROUP:

S.No	Name	Age	Sex	Wt	Dur of surg	Surgery	ASA
1	GOKUL	2	M	11	25	RT ENCYSTED HYDROCELE	1
2	SANJAY	2.5	M	10	30	RT INGUINAL HERNIA	1
3	HARINI	6	F	15	30	RT INGUINAL HERNIA	1
4	SAKTHIVEL	1	M	11	60	LT INGUINAL HERNIA	1
5	MANIKANDAN	3.5	M	14	60	LT HYDROCELE	1
6	MANIKANDAN	7	M	17	60	B/L HYDROCELE	1
7	TIRISH	1.5	M	9	30	RT HYDROCELE	1
8	SANJAY	2.5	M	10	30	RT HYDROCELE	1
9	RUPESH	5	M	14	35	LT HYDROCELE	1
10	LAXMI NARAYANAN	6	M	15	25	LT INGUINAL HERNIA	1
11	DHARSAN	4	M	13	35	LT INGUINAL HERNIA	1
12	SANTHOSH	4.5	M	17	40	RT ENCYSTED HYDROCELE	1
13	MAHAVISHNU	2	M	10	45	LT CONGENITAL HYDROCELE	1
14	SHYAM	4	M	11	20	RT INGUINAL HERNIA	1
15	VASANTHAKUMAR	8	M	17	45	RT HYDROCELE	1
16	JAWAHAR	6	M	16	30	LT HYDROCELE	1
17	ADITHYA	6	M	17	20	RT INGUINAL HERNIA	1
18	MANIKANDAN	4.5	M	14	30	LT INGUINAL HERNIA	1
19	HARISH RAGAVAN	2.5	M	10	20	LT CONGENITAL HYDROCELE	1
20	ABUBAKAR	1.5	M	10	60	RT INGUINAL HERNIA	1
21	TAMIL	2	M	10	25	LT INGUINAL HERNIA	1
22	ARUNKUMAR	8	M	20	20	LT INGUINAL HERNIA	1
23	SUMANRAJ	4	M	15	40	RT HYDROCELE	1
24	MADHAN	8	M	20	35	RT INGUINAL HERNIA	1
25	SUNIL	7	M	15	30	RT HYDROCELE	1
26	RUTHICK	4.5	M	15	40	RT HYDROCELE	1
27	VINAY	6	M	14	25	RT INGUINAL HERNIA	1
28	TAMILVENDAN	4	M	15	25	LT HYDROCELE	1
29	RAJADURAI	8	M	18	45	RT INGUINAL HERNIA	1
30	SANTHOSH	8	M	19	35	RT INGUINAL HERNIA	1

LEVOBUPIVACAINE GROUP:

S.No	Name	Age	Sex	Wt	Dur of surg	Surgery	ASA
1	MOHAMED IMRAN	2	M	10	45	LT HYDROCELE	1
2	BHUVANESHKUMAR	2.5	M	12	60	LT INGUINAL HERNIA	1
21	RITHISH	3	M	15	25	LT HYDROCELE	1
22	DEEPAK SHARAN	1	M	11	35	RT CONGENITAL HYDROCELE	1
23	STEPHAN MADHAVAN	7	M	17	40	LT INGUINAL HERNIA	1
24	SUMAIYA	2	F	10	35	LT INGUINAL HERNIA	1
25	PRASHANTH	1	M	12	25	RT INGUINAL HERNIA	1
37	ABINESH	3	M	12	45	LT INGUINAL HERNIA	1
38	KANISHA	4	M	13	30	LT INGUINAL HERNIA	1
39	VAISHNAVI	5	F	15	20	RT INGUINAL HERNIA	1
40	SAKTHIVEL	2	M	11	25	LT HYDROCELE	1
41	YUVARAJ	3	M	14	30	LT HYDROCELE	1
42	VEERAMANI	2.5	M	12	25	LT HYDROCELE	1
43	DEVANAD	3	M	13	35	RT HYDROCELE	1
44	UDHAYAKUMAR	2	M	10	20	LT HYDROCELE	1
45	MOHAMED USHMAN	2	M	10	20	RT HYDROCELE	1
46	VALLARASAN	2	M	9	25	LT HYDROCELE	1
47	SUNIL	6	M	17	35	LT INGUINAL HERNIA	1
48	GANESHWAR	1.5	M	8	20	RT HYDROCELE	1
49	VIGNESH	2	M	9	35	RT INGUINAL HERNIA	1
50	SATHESH	6	M	18	25	LT HYDROCELE	1
51	SAIPROMOTH	1.5	M	8	30	LT INGUINAL HERNIA	1
52	AJAYKRISHNAN	1.5	M	9	20	LT HYDROCELE	1
53	VISHWAJITH	1.5	M	7	40	RT INGUINAL HERNIA	1
54	JAYACHANDRAN	7	M	1	20	RT INGUINAL HERNIA	1
55	KAMESH SUNDAR	7	M	18	30	RT HYDROCELE	1
56	MUTHUKRISHNAN	4	M	15	35	RT HYDROCELE	1
57	VIKAS	5	M	15	25	RT INGUINAL HERNIA	1
58	JEEVANDAN	2.5	M	11	20	RT INGUINAL HERNIA	1
59	DINESH	3.5	M	15	20	LT HYDROCELE	1
60	KUMAR	8	M	19	35	RT INGUINAL HERNIA	

KETAMINE GROUP:

TIME OF ADMINISTRATION		POST- OP COMPLICATION				
Induction	Caudal	Resp Depression	Apnoea	Urinary retention	Nausea	Vomitting
9.45a.m	9.50a.m	NIL	NIL	NIL	NIL	NIL
10.40a.m	10.45a.m	NIL	NIL	NIL	NIL	NIL
11.30a.m	11.35a.m	NIL	NIL	NIL	NIL	NIL
9.30a.m	9.35a.m	NIL	NIL	NIL	NIL	NIL
10.30a.m	10.35a.m	NIL	NIL	PRESENT	NIL	NIL
11.40a.m	11.45a.m	NIL	NIL	NIL	NIL	NIL
9.05a.m	9.10a.m	NIL	NIL	NIL	NIL	NIL
9.25a.m	9.30a.m	NIL	NIL	NIL	PRESENT	PRESENT
9.40a.m	9.45a.m	NIL	NIL	PRESENT	NIL	NIL
10.05am	10.10a.m	NIL	NIL	NIL	NIL	NIL
10.25a.m	10.30a.m	NIL	NIL	NIL	PRESENT	PRESENT
9.15 a.m	9.20 a.m	NIL	NIL	NIL	NIL	NIL
9.10a.m	9.15a.m	NIL	NIL	NIL	NIL	NIL
9.45a.m	9.50a.m	NIL	NIL	NIL	NIL	NIL
9.50a.m	9.55a.m	NIL	NIL	NIL	NIL	NIL
10.45a.m	10.50a.m	NIL	NIL	NIL	NIL	NIL
9.45a.m	9.50 a.m	NIL	NIL	NIL	PRESENT	PRESENT
10.10 a.m	10.15 a.m	NIL	NIL	NIL	NIL	NIL
10.30 a.m	10.35 a.m	NIL	NIL	NIL	NIL	NIL
11.00 a.m	11.05 a.m	NIL	NIL	NIL	NIL	NIL
10.45 a.m	10.50 a.m	NIL	NIL	NIL	NIL	NIL
11.15 a.m	11.20 a.m	NIL	NIL	NIL	PRESENT	PRESENT
9.45 a.m	9.50 a.m	NIL	NIL	NIL	NIL	NIL
10.25 a.m	10.30 a.m	NIL	NIL	PRESENT	NIL	NIL
11.10 a.m	11.15 a.m	NIL	NIL	NIL	NIL	NIL
9.15 a.m	9.20 a.m	NIL	NIL	NIL	NIL	NIL
10.20a.m	10.25 a.m	NIL	NIL	NIL	NIL	NIL
11.15 a.m	11.20 a.m	NIL	NIL	NIL	NIL	NIL
10.15 a.m	10.20 a.m	NIL	NIL	NIL	NIL	NIL
10.10a.m	10.15am	NIL	NIL	NIL	NIL	NIL

LEVOBUPIVACAINE GROUP:

TIME OF ADMINISTRATION		POST- OP COMPLICATION				
Induction	Caudal	Resp Depression	Apnoea	Urinary retention	Nausea	Vomitting
9.30a.m	9.40a.m	NIL	NIL	NIL	NIL	NIL
10a.m	10.10a.m	NIL	NIL	NIL	NIL	NIL
9.20 a.m	9.25 a.m	NIL	NIL	NIL	NIL	NIL
9.50 a.m	9.55 a.m	NIL	NIL	NIL	NIL	NIL
10.15 a.m	10.20 a.m	NIL	NIL	PRESENT	NIL	NIL
10.25 a.m	10.30 a.m	NIL	NIL	NIL	NIL	NIL
9.40 a.m	9.45a.m	NIL	NIL	NIL	NIL	NIL
9.30a.m	9,.35a.m	NIL	NIL	NIL	PRESENT	PRESENT
9.40a.m	9.45a.m	NIL	NIL	NIL	NIL	NIL
11.30a.m	11.35a.m	NIL	NIL	NIL	NIL	NIL
11a.m	11.05am	NIL	NIL	NIL	NIL	NIL
10.20a.m	10.25a.m	NIL	NIL	PRESENT	NIL	NIL
9.55a.m	10a.m	NIL	NIL	NIL	NIL	NIL
10.10a.m	10.15a.m	NIL	NIL	NIL	NIL	NIL
11.15a.m	11.20a.m	NIL	NIL	NIL	NIL	NIL
11.25a.m	11.30a.m	NIL	NIL	NIL	NIL	NIL
10a.m	10.05am	NIL	NIL	NIL	NIL	NIL
10.25a.m	10.30a.m	NIL	NIL	NIL	NIL	NIL
10.25a.m	10.30a.m	NIL	NIL	PRESENT	NIL	NIL
10.45a.m	10.50a.m	NIL	NIL	NIL	NIL	NIL
9.50a.m	9.55a.m	NIL	NIL	NIL	NIL	NIL
9.55a.m	10a.m	NIL	NIL	NIL	NIL	NIL
12.05pm	12.10pm	NIL	NIL	NIL	NIL	NIL
12pm	12.05pm	NIL	NIL	NIL	NIL	NIL
11.40a.m	11.45a.m	NIL	NIL	NIL	NIL	NIL
10a.m	10.05a.m	NIL	NIL	NIL	NIL	NIL
10.30a.m	10.35a.m	NIL	NIL	NIL	NIL	NIL
10a.m	10.05am	NIL	NIL	NIL	NIL	NIL
11.20a.m	11.25a.m	NIL	NIL	NIL	NIL	NIL
9.40a.m	9.45a.m	NIL	NIL	NIL	NIL	NIL

KETAMINE GROUP – INTRA OPERATIVE BP (Systolic)

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
90	100	97	89	81	82					
114	60	82	80	80	84	84				
112	98	99	108	91	91	88				
102	63	85	80	81	82	84	82	82	86	86
82	93	89	90	88	86	82	84	83	84	86
130	100	81	78	77	78	80	80	84	80	82
102	88	85	80	81	82	84				
82	80	78	78	78	80	78				
104	102	100	98	96	94	98	94			
101	80	84	79	80	82					
78	78	80	82	84	82	88	88			
118	108	102	100	98	98	100	102	100		
109	88	90	90	90	92	88	86	90	90	
96	86	88	90	92						
118	116	110	104	100	98	98	92	90	90	
92	94	90	88	88	90	87				
88	90	92	86	86						
96	94	88	88	86	86	86				
96	90	88	88	86						
85	84	82	82	84	86	84	84	80	78	78
84	88	90	86	88	84					
110	108	102	100	98						
98	99	96	94	90	90	88	89	90		
114	110	104	106	106	106	100	98			
102	100	96	94	94	92	90				
98	98	94	95	92	90	90	88	88		
101	98	94	92	90	86					
90	99	90	86	86	88					
112	110	106	102	104	106	100	98	98	98	
106	102	104	100	96	96	98	96			

KETAMINE GROUP – INTRA OPERATIVE BP (Diastolic)

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
44	50	47	45	46	44					
68	33	42	45	44	49	49				
56	55	54	52	37	46	44				
82	46	51	52	51	52	52	54	56	54	56
46	60	57	58	57	58	52	54	51	54	54
74	70	48	42	41	42	44	46	48	50	50
82	46	51	52	51	52	52				
64	60	50	48	46	48	44				
68	64	66	58	55	52	56	52			
80	44	50	50	49	52					
42	40	44	44	50	44	50	48			
82	72	70	68	68	66	68	70	70		
78	68	66	70	68	64	60	64	64	64	
58	44	50	52	50						
78	76	70	74	70	68	64	62	60	64	
54	54	50	48	50	50	48				
60	60	60	58	56						
58	56	54	54	52	53	54				
70	66	58	56	54						
68	68	66	60	58	58	59	60	58	56	60
58	56	56	58	54	52					
80	76	78	74	74						
68	70	66	64	64	58	58	58	58		
80	76	74	75	76	74	70	72			
76	74	60	66	66	62	58				
70	66	62	60	58	56	56	58	58		
80	76	74	74	70	65					
64	62	60	56	54	56					
74	70	68	60	62	60	60	56	58	60	
70	66	64	64	60	58	56	54			

KETAMINE GROUP – INTRA OPERATIVE BP (MAP)

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
59.33	66.67	63.67	59.67	57.67	56.67					
83.33	42.00	55.33	56.67	56.00	60.67	60.67				
74.67	69.33	69.00	70.67	55.00	61.00	58.67				
88.67	51.67	62.33	61.33	61.00	62.00	62.67	63.33	64.67	64.67	66.00
58.00	71.00	67.67	68.67	67.33	67.33	62.00	64.00	61.67	64.00	64.67
92.67	80.00	59.00	54.00	53.00	54.00	56.00	57.33	60.00	60.00	60.67
88.67	60.00	62.33	61.33	61.00	62.00	62.67				
70.00	66.67	59.33	58.00	56.67	58.67	55.33				
80.00	76.67	77.33	71.33	68.67	66.00	70.00	66.00			
87.00	56.00	61.33	59.67	59.33	62.00					
54.00	52.67	56.00	56.67	61.33	56.67	62.67	61.33			
94.00	84.00	80.67	78.67	78.00	76.67	78.67	80.67	80.00		
88.33	74.67	74.00	76.67	75.33	73.33	69.33	71.33	72.67	72.67	
70.67	58.00	62.67	64.67	64.00						
91.33	89.33	83.33	84.00	80.00	78.00	75.33	72.00	70.00	72.67	
66.67	67.33	63.33	61.33	62.67	63.33	61.00				
69.33	70.00	70.67	67.33	66.00						
70.67	68.67	65.33	65.33	63.33	64.00	64.67				
78.67	74.00	68.00	66.67	64.67						
73.67	73.33	71.33	67.33	66.67	67.33	67.33	68.00	65.33	63.33	66.00
66.67	66.67	67.33	67.33	65.33	62.67					
90.00	86.67	86.00	82.67	82.00						
78.00	79.67	76.00	74.00	72.67	68.67	68.00	68.33	68.67		
91.33	87.33	84.00	85.33	86.00	84.67	80.00	80.67			
84.67	82.67	72.00	75.33	75.33	72.00	68.67				
79.33	76.67	72.67	71.67	69.33	67.33	67.33	68.00	68.00		
87.00	83.33	80.67	80.00	76.67	72.00					
72.67	74.33	70.00	66.00	64.67	66.67					
86.67	83.33	80.67	74.00	76.00	75.33	73.33	70.00	71.33	72.67	
82.00	78.00	77.33	76.00	72.00	70.67	70.00	68.00			

LEVOBUPIVACAINE GROUP – INTRA OPERATIVE BP (Systolic)

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
90	84	82	85	80	80	82	84	80	84	
82	80	78	78	78	76	78	78	78	76	78
86	87	88	84	82	82					
78	80	80	76	78	78	76	76			
108	106	100	99	96	98	98	96	98		
90	88	88	87	86	86	84	84			
84	86	86	84	84	82					
78	80	82	78	76	76	76	74	74	76	
97	98	94	92	90	90	88				
102	100	96	94	90						
98	88	86	86	84	84					
93	82	88	88	86	84	86				
88	78	86	86	84	82					
96	86	86	84	82	82	84	82			
89	84	83	80	78						
85	80	78	80	78						
102	88	88	86	80	78					
104	100	96	92	90	88	90	86			
81	68	78	78	76						
87	86	84	86	84	80	80	80			
97	88	90	87	86	86					
96	84	82	84	84	82	80				
87	88	84	84	82						
96	88	86	86	84	80	76	78	76		
104	100	94	94	92						
112	102	100	96	96	96	95				
97	86	92	92	90	88	89	90			
89	76	86	84	84	82					
98	86	86	80	82						
100	86	88	84	82						

LEVOBUPIVACAINE GROUP – INTRA OPERATIVE BP (Diastolic)

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
50	34	39	49	44	40	42	44	40	46	
60	54	48	46	44	42	44	44	46	44	44
56	53	54	52	52	50					
54	54	52	52	49	48	48	48			
76	76	75	68	68	66	64	64	63		
58	60	58	56	56	54	49	48			
58	54	55	54	52	50					
58	58	60	56	56	54	54	54	56	52	
64	66	60	60	58	58	56				
74	72	70	66	62						
64	64	60	56	54	52					
64	58	60	56	56	54	54				
62	50	58	56	54	54					
70	66	64	62	60	58	58	58			
66	64	62	62	60						
65	60	58	58	56						
70	66	68	64	60	60					
72	70	64	60	58	56	56	54			
58	46	56	54	54						
60	58	56	54	56	54	52	50			
64	62	60	58	56	54					
68	56	56	58	54	52	54				
60	56	50	48	50						
70	64	64	62	60	56	54	54	50		
70	66	64	62	60						
76	66	64	62	62	60	60				
64	54	60	62	60	58	58	56			
62	54	64	62	60	58					
70	66	64	58	58						
68	58	58	56	56						

LEVOBUPIVACAINE GROUP – INTRA OPERATIVE BP (MAP)

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
63.33	50.67	53.33	61.00	56.00	53.33	55.33	57.33	53.33	58.67	
67.33	62.67	58.00	56.67	55.33	53.33	55.33	55.33	56.67	54.67	55.33
66.00	64.33	65.33	62.67	62.00	60.67					
62.00	62.67	61.33	60.00	58.67	58.00	57.33	57.33			
86.67	86.00	83.33	78.33	77.33	76.67	75.33	74.67	74.67		
68.67	69.33	68.00	66.33	66.00	64.67	60.67	60.00			
66.67	64.67	65.33	64.00	62.67	60.67					
64.67	65.33	67.33	63.33	62.67	61.33	61.33	60.67	62.00	60.00	
75.00	76.67	71.33	70.67	68.67	68.67	66.67				
83.33	81.33	78.67	75.33	71.33						
75.33	72.00	68.67	66.00	64.00	62.67					
73.67	66.00	69.33	66.67	66.00	64.00	64.67				
70.67	59.33	67.33	66.00	64.00	63.33					
78.67	72.67	71.33	69.33	67.33	66.00	66.67	66.00			
73.67	70.67	69.00	68.00	66.00						
71.67	66.67	64.67	65.33	63.33						
80.67	73.33	74.67	71.33	66.67	66.00					
82.67	80.00	74.67	70.67	68.67	66.67	67.33	64.67			
65.67	53.33	63.33	62.00	61.33						
69.00	67.33	65.33	64.67	65.33	62.67	61.33	60.00			
75.00	70.67	70.00	67.67	66.00	64.67					
77.33	65.33	64.67	66.67	64.00	62.00	62.67				
69.00	66.67	61.33	60.00	60.67						
78.67	72.00	71.33	70.00	68.00	64.00	61.33	62.00	58.67		
81.33	77.33	74.00	72.67	70.67						
88.00	78.00	76.00	73.33	73.33	72.00	71.67				
75.00	64.67	70.67	72.00	70.00	68.00	68.33	67.33			
71.00	61.33	71.33	69.33	68.00	66.00					
79.33	72.67	71.33	65.33	66.00						
78.67	67.33	68.00	65.33	64.67						

KETAMINE GROUP – INTRA OPERATIVE PR

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
114	122	124	122	120	117					
110	83	84	83	88	90	92				
106	104	96	107	80	77	76				
106	102	100	96	92	90	94	88	96	95	93
96	117	83	82	82	80	73	74	76	84	80
92	94	114	93	91	94	96	98	100	99	101
106	102	100	96	90	90	88				
128	110	116	108	109	106	109				
112	108	114	113	108	103	106	110			
104	100	91	94	86	90					
98	94	104	104	106	99	98	100			
122	123	114	108	109	114	118	123	116		
130	112	120	123	118	119	123	112	110	108	
114	102	106	98	94						
108	114	97	103	99	97	96	90	88	90	
96	92	92	90	88	94	86				
108	107	110	103	99						
124	1124	116	114	108	110	112				
126	124	120	114	110						
130	126	124	119	120	120	118	118	114	110	112
118	116	122	110	108	110					
98	96	94	90	92						
106	110	102	100	101	102	99	98	96		
103	105	100	101	98	99	96	96			
98	97	99	94	92	90	88				
104	102	106	96	93	94	92	94	91		
112	106	108	107	102	100					
122	120	118	117	108	107					
96	98	94	90	92	91	90	89	92	90	
99	90	96	92	93	89	88	90			

LEVOBUPIVACAINE GROUP – INTRA OPERATIVE PR

0 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	60 min
114	119	120	122	99	99	94	92	90	89	
106	104	100	94	96	92	94	90	88	90	92
132	130	118	114	110	109					
138	134	130	122	116	112	109	108			
110	108	98	96	98	99	92	94	90		
129	126	122	120	114	116	114	108			
136	134	128	120	118	110					
117	120	118	112	110	104	102	106	107	100	
124	126	118	110	106	106	104				
118	124	114	106	102						
132	130	118	116	118	112					
123	121	118	117	116	112	107				
137	130	122	118	119	110					
123	128	120	122	118	116	114	112			
130	122	126	120	117						
125	128	120	118	111						
140	128	118	117	113	109					
109	110	102	98	96	97	93	91			
135	128	119	115	109						
127	123	108	109	110	107	105	105			
99	104	97	94	95	90					
125	116	114	119	109	107	108				
134	135	122	117	115						
138	127	126	123	119	118	117	115	112		
107	105	99	97	92						
110	108	97	102	96	92	90				
113	124	114	109	107	109	110	105			
126	122	130	117	115	106					
133	135	127	116	114						
118	117	110	109	107						

KETAMINE GROUP – POST- OPERATIVE BP (Systolic)

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
86	88	88	90	92	93	94	94	96	98
84	85	86	88	90	90	92	94	92	
88	89	90	91	92	93	94	94	96	
84	86	86	88	90	90	94	94	92	96
84	84	88	90	92	93	94	94	96	98
84	90	92	94	96	96	97	98	100	
84	86	88	90	90	90	88	92	98	
80	80	82	80	80	82	86	88	90	
90	88	90	90	86	92	94	98	98	
90	86	92	100	94	96	94	98	100	102
88	90	90	92	92	94	94	96	98	
100	101	100	104	106	106	106	108	112	116
90	90	92	94	94	96	96	98	98	104
90	90	92	92	94	94	96	94	100	
90	90	92	92	94	96	96	98	104	
92	90	92	92	94	96	96	104	106	
86	84	84	83	86	86	86	88	94	100
86	88	84	84	88	89	90	94		
86	86	88	90	92	90	92	94	94	102
78	78	80	80	82	86	88	90	90	98
84	84	86	87	89	90	90	95	95	
98	98	100	100	100	102	110	112		
90	90	94	94	96	98	100	104	104	
98	96	94	96	99	100	102	105	106	
90	88	90	92	94	96	96	99	99	108
88	88	86	88	90	92	92	96	96	105
86	88	84	85	88	90	94	94	96	102
86	84	86	87	87	90	92	94	94	
98	98	96	99	99	100	102	106	106	112
96	94	94	96	96	98	100	100	100	111

KETAMINE GROUP – POST- OPERATIVE BP (Diastolic)

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
46	48	50	52	54	54	55	56	56	60
50	52	54	56	58	52	54	58	54	
44	45	46	46	46	46	46	46	44	
54	54	56	57	58	60	56	60	60	62
54	54	56	60	62	63	64	64	64	64
46	48	50	54	56	56	58	57	60	
54	56	57	58	60	60	60	62	64	
46	44	48	48	50	48	52	60	54	
52	54	53	50	52	54	56	58	56	
54	50	52	60	56	54	56	58	58	60
48	50	50	52	52	54	56	54	60	
70	70	72	70	70	72	74	76	78	80
64	64	64	64	60	60	63	62	68	70
50	50	54	54	54	54	54	54	56	
64	60	62	64	64	64	66	66	68	
64	62	64	64	65	66	67	70	72	
56	54	54	54	56	57	60	60	62	64
54	54	54	56	56	56	60	62		
54	56	58	60	60	60	62	64	64	66
60	62	64	60	62	64	64	64	64	66
52	54	54	54	56	60	62	64	64	
74	76	76	74	76	77	76	76		
58	58	56	56	58	60	62	64	64	
72	70	70	70	74	74	74	74	74	
58	56	56	58	60	62	60	60	60	68
56	56	54	56	60	62	62	64	64	66
65	66	65	64	64	64	66	64	64	67
54	54	56	56	56	58	60	60	60	
58	58	56	58	60	62	62	62	62	64
54	60	60	54	56	58	60	60	60	64

KETAMINE GROUP – POST- OPERATIVE BP (MAP)

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
59.33	61.33	62.67	64.67	66.67	67.00	68.00	68.67	69.33	72.67
61.33	63.00	64.67	66.67	68.67	64.67	66.67	70.00	66.67	
58.67	59.67	60.67	61.00	61.33	61.67	62.00	62.00	61.33	
64.00	64.67	66.00	67.33	68.67	70.00	68.67	71.33	70.67	73.33
64.00	64.00	66.67	70.00	72.00	73.00	74.00	74.00	74.67	75.33
58.67	62.00	64.00	67.33	69.33	69.33	71.00	70.67	73.33	
64.00	66.00	67.33	68.67	70.00	70.00	69.33	72.00	75.33	
57.33	56.00	59.33	58.67	60.00	59.33	63.33	69.33	66.00	
64.67	65.33	65.33	63.33	63.33	66.67	68.67	71.33	70.00	
66.00	62.00	65.33	73.33	68.67	68.00	68.67	71.33	72.00	74.00
61.33	63.33	63.33	65.33	65.33	67.33	68.67	68.00	72.67	
80.00	80.33	81.33	81.33	82.00	83.33	84.67	86.67	89.33	92.00
72.67	72.67	73.33	74.00	71.33	72.00	74.00	74.00	78.00	81.33
63.33	63.33	66.67	66.67	67.33	67.33	68.00	67.33	70.67	
72.67	70.00	72.00	73.33	74.00	74.67	76.00	76.67	80.00	
73.33	71.33	73.33	73.33	74.67	76.00	76.67	81.33	83.33	
66.00	64.00	64.00	63.67	66.00	66.67	68.67	69.33	72.67	76.00
64.67	65.33	64.00	65.33	66.67	67.00	70.00	72.67		
64.67	66.00	68.00	70.00	70.67	70.00	72.00	74.00	74.00	78.00
66.00	67.33	69.33	66.67	68.67	71.33	72.00	72.67	72.67	76.67
62.67	64.00	64.67	65.00	67.00	70.00	71.33	74.33	74.33	
82.00	83.33	84.00	82.67	84.00	85.33	87.33	88.00		
68.67	68.67	68.67	68.67	70.67	72.67	74.67	77.33	77.33	
80.67	78.67	78.00	78.67	82.33	82.67	83.33	84.33	84.67	
68.67	66.67	67.33	69.33	71.33	73.33	72.00	73.00	73.00	81.33
66.67	66.67	64.67	66.67	70.00	72.00	72.00	74.67	74.67	79.00
72.00	73.33	71.33	71.00	72.00	72.67	75.33	74.00	74.67	78.67
64.67	64.00	66.00	66.33	66.33	68.67	70.67	71.33	71.33	
71.33	71.33	69.33	71.67	73.00	74.67	75.33	76.67	76.67	80.00
68.00	71.33	71.33	68.00	69.33	71.33	73.33	73.33	73.33	79.67

LEVOBUPIVACAINE GROUP – POST- OPERATIVE BP (Systolic)

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
90	92	94	92	94	90	92			
78	80	82	80	80	78	80	80		
82	80	84	84	80	86	90			
76	76	80	80	84	86	90	92		
98	98	96	100	102	106				
84	86	86	88	90	90	94			
82	82	84	86	86	88	90	94		
76	78	76	80	80	80				
88	88	88	90	90	90	92			
90	90	90	92	92	92	94	99		
84	84	86	86	88	90				
86	84	84	86	88	94	96			
82	80	85	88	90	90	95			
82	80	82	84	86	90				
78	76	80	82	84	85	88	96		
78	80	78	80	80	82	88			
78	80	80	82	84	88				
86	86	85	86	88	96				
76	78	80	80	82	84	87			
80	80	82	82	87	93				
84	84	84	85	86	88	98			
80	80	82	82	82	84	84	92		
82	84	86	86	88	96				
76	76	80	82	92					
92	90	90	94	94	94	102			
95	92	94	93	96	96	106			
90	90	90	93	94	96	96	106		
82	80	84	84	88	89	97			
82	82	85	88	96					
83	84	84	89	88	97				

LEVOBUPIVACAINE GROUP – POST- OPERATIVE BP (Diastolic)

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
42	42	46	44	46	44	44			
46	44	46	48	46	46	46	44		
50	50	52	54	54	54	56			
48	50	50	52	52	54	56	56		
63	62	62	64	64	66				
48	46	44	45	46	48	50			
50	50	52	54	54	56	56	58		
54	54	56	58	58	56				
60	56	58	58	60	62	62			
62	64	64	62	65	64	64	65		
52	52	56	56	56	60				
54	54	54	54	56	56	58			
54	55	56	56	60	58	60			
60	60	58	60	62	60				
60	60	62	62	64	64	64	66		
56	56	60	62	64	58	64			
60	60	60	60	60	64				
55	55	56	58	58	65				
56	59	59	60	62	62	64			
50	50	52	54	52	60				
55	55	56	56	56	56	62			
54	54	56	54	56	60	60	64		
50	52	52	54	54	58				
50	52	50	54	60					
60	60	60	62	62	64	66			
60	60	60	60	62	60	65			
56	58	57	57	58	60	58	60		
58	58	58	60	62	62	64			
58	60	60	65	65					
55	56	56	58	58	60				

LEVOBUPIVACAINE GROUP – POST- OPERATIVE BP (MAP)

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
58.00	58.67	62.00	60.00	62.00	59.33	60.00			
56.67	56.00	58.00	58.67	57.33	56.67	57.33	56.00		
60.67	60.00	62.67	64.00	62.67	64.67	67.33			
57.33	58.67	60.00	61.33	62.67	64.67	67.33	68.00		
74.67	74.00	73.33	76.00	76.67	79.33				
60.00	59.33	58.00	59.33	60.67	62.00	64.67			
60.67	60.67	62.67	64.67	64.67	66.67	67.33	70.00		
61.33	62.00	62.67	65.33	65.33	64.00				
69.33	66.67	68.00	68.67	70.00	71.33	72.00			
71.33	72.67	72.67	72.00	74.00	73.33	74.00	76.33		
62.67	62.67	66.00	66.00	66.67	70.00				
64.67	64.00	64.00	64.67	66.67	68.67	70.67			
63.33	63.33	65.67	66.67	70.00	68.67	71.67			
67.33	66.67	66.00	68.00	70.00	70.00				
66.00	65.33	68.00	68.67	70.67	71.00	72.00	76.00		
63.33	64.00	66.00	68.00	69.33	66.00	72.00			
66.00	66.67	66.67	67.33	68.00	72.00				
65.33	65.33	65.67	67.33	68.00	75.33				
62.67	65.33	66.00	66.67	68.67	69.33	71.67			
60.00	60.00	62.00	63.33	63.67	71.00				
64.67	64.67	65.33	65.67	66.00	66.67	74.00			
62.67	62.67	64.67	63.33	64.67	68.00	68.00	73.33		
60.67	62.67	63.33	64.67	65.33	70.67				
58.67	60.00	60.00	63.33	70.67					
70.67	70.00	70.00	72.67	72.67	74.00	78.00			
71.67	70.67	71.33	71.00	73.33	72.00	78.67			
67.33	68.67	68.00	69.00	70.00	72.00	70.67	75.33		
66.00	65.33	66.67	68.00	70.67	71.00	75.00			
66.00	67.33	68.33	72.67	75.33					
64.33	65.33	65.33	68.33	68.00	72.33				

KETAMINE GROUP – POST- OPERATIVE PR

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
122	120	118	116	122	124	122	118	128	130
84	82	80	84	90	88	86	90	96	
78	80	82	86	89	96	99	97	98	
86	86	88	90	94	96	98	97	94	102
78	76	78	80	80	76	82	84	85	90
100	102	116	101	103	104	110	106	112	
88	86	90	94	96	98	94	102	105	
114	110	107	106	103	110	112	117	118	
110	108	102	100	108	107	112	109	116	
96	90	88	95	101	96	98	100	106	104
90	90	94	96	94	96	100	102	109	
114	110	116	114	110	112	117	119	118	122
118	116	116	114	110	110	109	115	115	118
94	92	92	90	93	96	97	98	102	
96	96	98	99	96	98	100	102	110	
97	98	94	94	93	96	100	103	117	
99	96	96	94	95	93	96	99	102	106
108	106	103	106	104	102	110	115		
112	109	108	110	111	113	112	116	114	120
108	104	105	110	112	110	113	103	116	122
110	102	100	103	104	105	101	108	115	
92	94	90	91	93	95	97	104		
102	100	99	102	106	103	105	110	117	
99	95	94	96	92	98	93	102	110	
90	94	95	95	94	96	90	99	95	102
94	95	91	96	93	98	102	100	102	110
100	96	98	95	99	96	100	102	103	109
107	105	107	108	108	109	110	110	116	
91	90	88	88	87	90	92	96	94	100
88	89	87	89	88	91	92	95	98	108

LEVOBUPIVACAINE GROUP – POST- OPERATIVE PR

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
94	96	98	96	100	94	98			
94	98	100	96	94	94	96	94		
109	110	102	100	102	112	116			
112	110	110	109	106	110	116	120		
96	94	94	93	97	100				
114	112	110	115	117	116	120			
110	112	105	106	116	118	116	118		
104	106	102	105	108	108				
106	102	100	102	103	105	110			
102	105	107	102	109	108	113	114		
112	110	109	112	114	118				
110	107	106	107	110	112	117			
107	106	105	110	114	112	118			
114	112	110	115	114	120				
117	115	111	115	117	112	113	122		
111	107	105	112	115	116	120			
109	105	105	104	110	118				
97	96	95	97	100	108				
113	113	117	115	114	115	123			
107	102	104	104	110	117				
90	91	92	96	95	94	102			
105	101	103	105	108	109	107	117		
115	112	111	110	117	119				
118	116	117	115	127					
93	94	96	94	92	99	108			
91	90	93	94	92	97	110			
106	99	97	99	98	100	104	112		
105	103	105	105	102	106	116			
114	112	111	113	119					
107	102	101	105	110	117				

KETAMINE GROUP – POST- OPERATIVE SPO_2

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99			
99	99	99	99	99	99				
99	99	99	99	99	99	99	99		
99	99	99	99	99	99	99			
99	99	99	99	99	99				
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99					
99	99	99	99	99	99	99			
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99	99			
99	99	99	99	99					
99	99	99	99	99	99				

LEVOBUPIVACAINE GROUP – POST- OPERATIVE SPO_2

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99			
99	99	99	99	99	99				
99	99	99	99	99	99	99	99		
99	99	99	99	99	99	99			
99	99	99	99	99	99				
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99				
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99				
99	99	99	99	99					
99	99	99	99	99	99	99			
99	99	99	99	99	99	99			
99	99	99	99	99	99	99	99		
99	99	99	99	99	99	99			
99	99	99	99	99					
99	99	99	99	99	99				

KETAMINE GROUP – POST- OPERATIVE FLACC PAIN SCORE

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
0	0	0	0	0	0	0	0	3	4
0	0	0	0	0	0	0	2	4	
0	0	0	0	0	0	0	2	4	
0	0	0	0	0	0	0	0	3	4
0	0	0	0	0	0	0	2	3	4
0	0	0	0	0	0	0	3	4	
0	0	0	0	0	0	0	2	4	
0	0	0	0	0	0	0	3	4	
0	0	0	0	0	0	2	3	4	
0	0	0	0	0	0	0	0	2	4
0	0	0	0	0	0	0	2	4	
0	0	0	0	0	0	0	2	3	4
0	0	0	0	0	0	0	0	3	4
0	0	0	0	0	0	2	3	4	
0	0	0	0	0	0	0	3	4	
0	0	0	0	0	0	2	3	4	
0	0	0	0	0	0	0	3	3	4
0	0	0	0	0	0	3	4		
0	0	0	0	0	0	0	2	3	4
0	0	0	0	0	0	0	0	3	4
0	0	0	0	0	0	0	2	4	
0	0	0	0	0	0	3	4		
0	0	0	0	0	0	0	2	4	
0	0	0	0	0	0	0	2	4	
0	0	0	0	0	0	0	2	3	4
0	0	0	0	0	0	0	3	3	4
0	0	0	0	0	0	0	2	2	4
0	0	0	0	0	0	0	3	4	
0	0	0	0	0	0	0	2	2	4
0	0	0	0	0	0	0	0	2	4

LEVOBUPIVACAINE GROUP – POST- OPERATIVE FLACC PAIN SCORE

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr
0	0	0	0	2	3	4			
0	0	0	0	0	2	3	4		
0	0	0	0	2	3	4			
0	0	0	0	0	3	3	4		
0	0	0	0	3	4				
0	0	0	0	2	3	4			
0	0	0	0	0	3	3	4		
0	0	0	0	3	4				
0	0	0	0	2	2	4			
0	0	0	0	0	2	3	4		
0	0	0	0	3	4				
0	0	0	0	2	3	4			
0	0	0	0	2	2	4			
0	0	0	0	3	4				
0	0	0	0	0	0	3	4		
0	0	0	0	0	2	4			
0	0	0	0	3	4				
0	0	0	0	2	4				
0	0	0	0	2	2	4			
0	0	0	0	3	4				
0	0	0	0	2	3	4			
0	0	0	0	2	2	3	4		
0	0	0	0	3	4				
0	0	0	3	4					
0	0	0	0	0	3	4			
0	0	0	0	0	2	4			
0	0	0	0	2	2	3	4		
0	0	0	0	0	3	4			
0	0	0	3	4					
0	0	0	0	2	4				

KETAMINE GROUP – POST- OPERATIVE RSS& RESCUE ANALGESIA

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr	RESCUE ANALGESIA
5	4	4	3	3	3	2	2	2	1	12
5	4	3	3	3	3	2	2	2		10
5	4	4	3	3	2	2	2	1		10
5	4	4	3	2	2	2	2	2	1	12
5	4	4	4	3	3	2	2	2	1	12
5	4	3	3	3	3	3	2	1		10
5	4	4	4	3	3	2	2	1		10
5	4	4	4	3	3	2	2	1		10
5	4	3	3	2	2	2	2	1		10
5	4	3	3	3	3	2	2	2	1	12
5	4	4	3	3	3	2	2	1		10
5	4	4	3	3	3	3	3	2	1	12
5	4	3	3	3	3	2	2	2	1	12
5	4	4	4	3	3	2	2	1		10
5	3	3	3	3	3	2	2	1		10
5	3	3	3	3	3	3	2	1		10
4	3	3	3	3	2	2	2	2	1	12
5	4	4	3	3	2	2	1			8
5	3	3	3	3	2	2	2	2	1	12
5	4	4	4	3	3	2	2	2	1	12
4	3	3	3	2	2	2	2	1		10
4	3	3	2	2	2	2	1			8
5	3	3	3	3	2	2	2	1		10
5	3	3	3	3	3	2	2	1		10
5	3	3	3	2	2	2	2	2	1	12
5	3	3	2	2	2	2	2	2	1	12
5	3	3	3	2	2	2	2	2	1	12
5	4	3	3	2	2	2	2	1		10
5	4	4	3	3	3	2	2	2	1	12
5	4	4	4	3	3	3	2	2	1	12

LEVOBUPIVACAINE GROUP – POST- OPERATIVE RSS & RESCUE ANALGESIA

30 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	8 hr	10 hr	12 hr	RESCUE ANALGESIA
5	3	3	3	2	2	1				6
5	4	4	3	3	3	2	1			8
5	3	3	2	2	2	1				6
5	4	4	3	3	2	2	1			8
4	4	3	2	2	1					5
5	4	4	3	2	2	1				6
5	3	3	3	3	2	2	1			8
5	3	2	2	2	1					5
5	4	3	3	3	2	1				6
5	4	3	3	2	2	2	1			8
5	4	3	3	2	1					5
5	3	3	3	3	2	1				6
5	4	3	3	2	2	1				6
5	3	2	2	2	1					5
5	4	3	3	2	2	2	1			8
5	4	3	3	2	2	1				6
5	3	3	3	2	1					5
5	3	2	2	2	1					5
5	3	3	3	2	2	1				6
5	4	3	2	2	1					5
5	3	3	2	2	2	1				6
5	4	3	3	3	2	2	1			8
5	3	3	2	2	1					5
5	3	2	2	1						4
5	4	4	3	2	2	1				6
5	3	3	2	2	2	1				6
5	4	3	3	2	2	2	1			8
5	3	3	2	2	2	1				6
5	3	2	2	1						4
5	3	2	2	2	1					5